THE DISTRIBUTION OF REPTILES AND AMPHIBIANS IN THE ANNAPURNA-DHAULAGIRI REGION (NEPAL)

by

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Key words: reptiles; amphibians; keys; Annapurna region; Dhaulagiri region; Nepal; altitudinal distribution; zoogeography.

The reptiles and amphibians of the Annapurna-Dhaulagiri region in Nepal are keyed and described. Their distribution is recorded, based on both personal observations and literature data. The ecology of the species is discussed. The zoogeography and the altitudinal distribution are analysed. All in all 32 species-group taxa of reptiles and 21 species-group taxa of amphibians are treated.

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INTRODUCTION

Mountains, in spite of their inaccessibility, have always attracted the interest of zoogeographers. They act as faunal barriers and with their isolated valleys and mountain tops and the enormous variation in microclimate and vegetation, they offer niches to an unknown number of life forms, with as many zoogeographical problems. In this respect the Himalayas probably surpass everything (together with the mountains of Szechwan), not only because of the great number of life forms but also in respect of the inaccessibility. This is the reason why still little is known of the animals living in this extensive area.

As for the reptiles and amphibians, the data of the first collectors are of little use because their locality data usually were inaccurate and incomplete. Nevertheless, so many data were collected, that Swan & Leviton (1962) provided the first zoogeographical analysis of the herpetofauna of the most important Himalaya state, Nepal. It led to some interesting tentative conclusions and it is still a good basis for further studies.

One of their interesting conclusions, already indicated by observations of Leviton, Myers & Swan (1956), was that certain species on the northern side of the Himalayas are found at much higher altitude than on the southern side. This conclusion, however, is based on observations in eastern Nepal for the southern side and in western Nepal for the northern side of the Himalayas. In April and May 1981, we trekked around the Annapurna Himal in Central Nepal in order to study the altitudinal distribution of the herpetofauna on "one mountain". We also wished to test a hypothesis that explains the occurrence in higher altitudes of reptiles and amphibians on the northern side of the Himalayas. This hypothesis is based on the results of research into the ther-

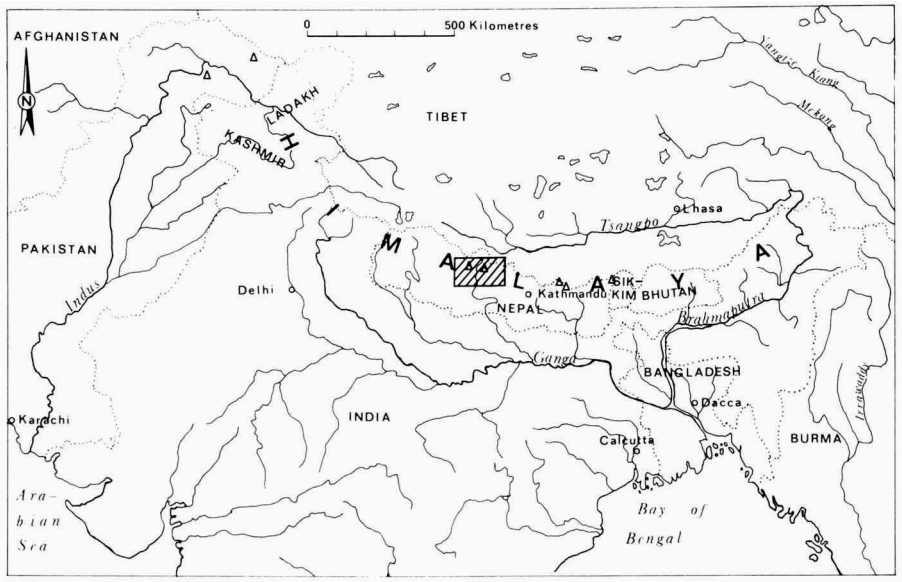

Fig. 1. The Himalayan region. The shaded area is the Annapurna-Dhaulagiri region.

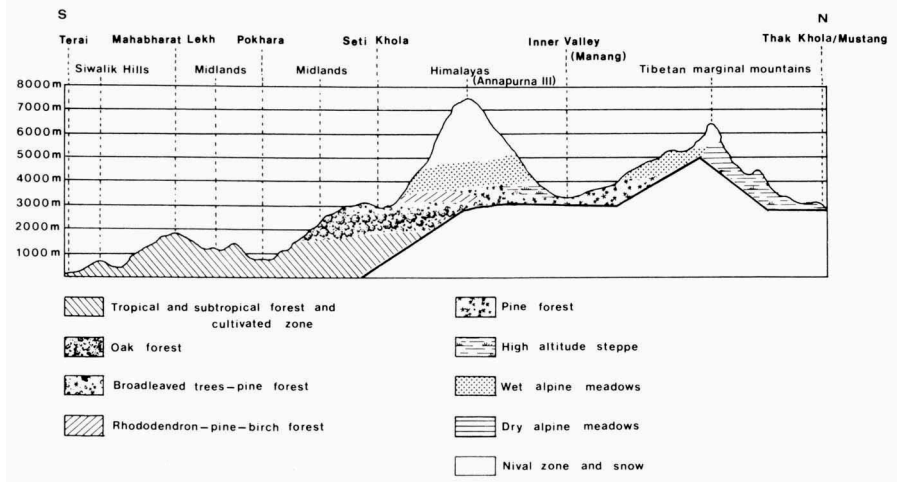

Fig. 2. Cross-section of Nepal at about 84°E.L. (Pokhara); altitudinal and latitudinal distribution of vegetation zones.

moregulation of heliotherm lizards in cold environments (e.g. Spellerberg, 1976; Pearson & Bradford, 1976). The southern side of the Central and Eastern Himalayas is extremely wet, especially during the warmest months of the year. The continuous cloudiness in and above the monsoon forests limits the number of sun hours to such an extent that most reptiles and amphibians are unable to live there, because they can seldom reach their preferred body-temperature. The northern side of the Himalayas is in the rainshadow of the mountains. Here the number of sun hours in high, so that poikilotherm animals are able to survive at higher altitudes. For example *Scincella ladacensis* (Günther) reaches an altitude of 5500 m at Kahajeng Khola (Smith & Battersby, 1953) and is found still active in November at an altitude of 4500 m near Shey Gompa (Matthiessen, 1978).

The hypothesis, that especially the number of available sun hours determines the suitability of a mountain area for heliotherm (and thigmotherm) animals, was also supported by observations on Mt. Kenya (Eastern Africa) in 1980. Here the most common lizard *Algyroides alleni* Barbour was totally absent on the southwestern cloudy side of the mountain (Teleki Valley) (pers. obs.). In this paper we present several data that seem to confirm the hypothesis for the Annapurna range.

In July 1981 we trekked along the southern side of the Dhaulagiri Himal. All data taken together, including the data already available in collections and literature, the Annapurna-Dhaulagiri area is now one of the best studied areas of the Himalayas.

STUDY AREA
(figs. 1, 3)

The study area consisted of the Dhaulagiri Himal, the Annapurna Himal and the surrounding valleys, as well as the Midland Hills south of these mountain ranges. The western limit of the study area is at about 82°E (Tarakot, Jangla Pass), the eastern limit at about 84°30'E (Marsyandi Valley). The Barbung Khola Valley north of the Dhaulagiri Himal determines the northern limit at about 29°N. In the south the Midland Hills are bordered by a higher mountain range, the Mahabharat Lekh; in the Annapurna-Dhaulagiri region the transition is at about 28°N. A cross-section of Nepal at about 84°E (Pokhara) is shown in fig. 2.

Troll (1967) has partitioned the Himalayas into six parts on the basis of their vegetation. The study area is in two of these parts. The Garhwal Himalayas extend from about Simla in the west (Himachal Pradesh) till the

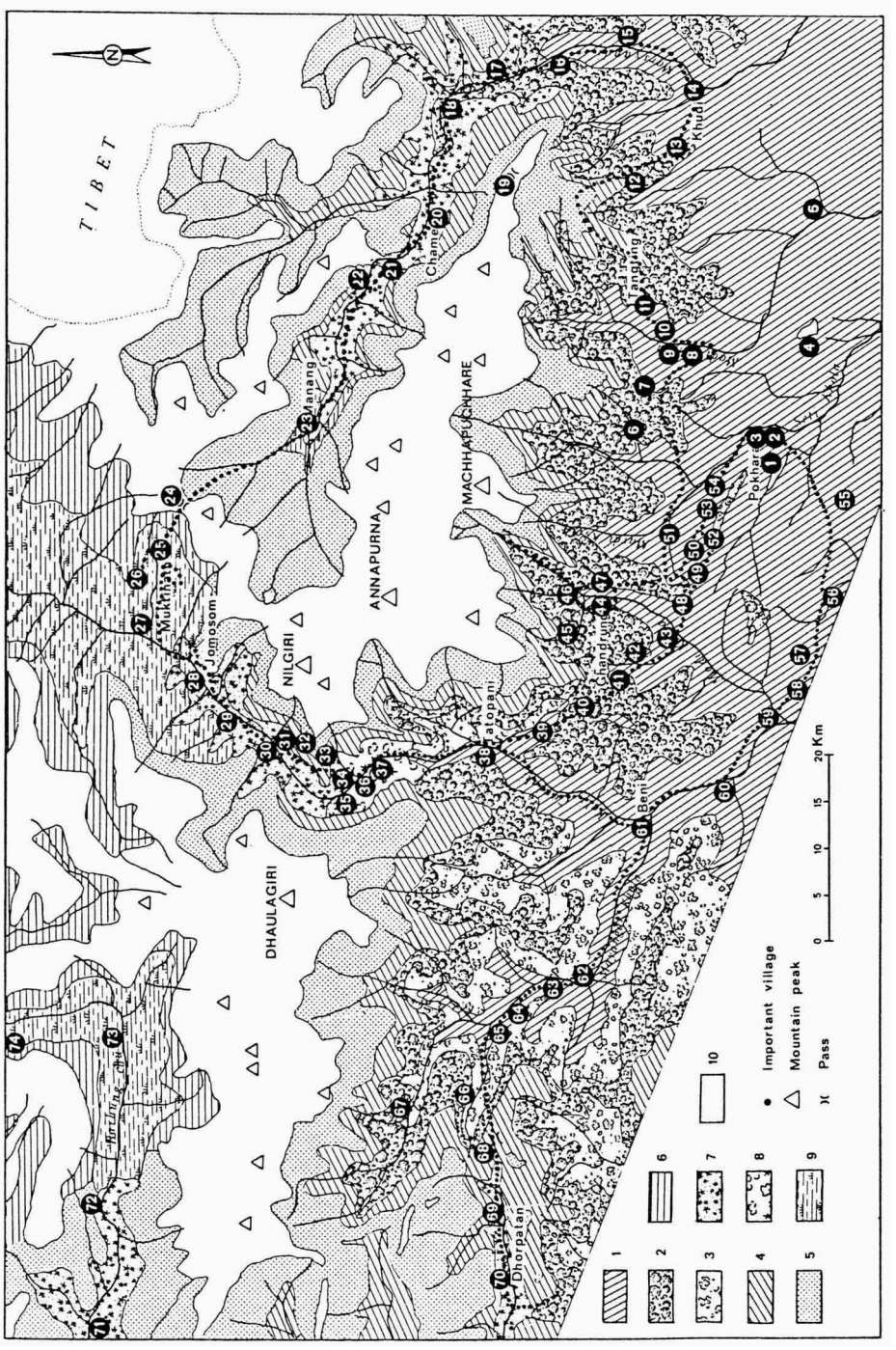

Fig. 3. Vegetation types in the Annapurna-Dhaulagiri region, route followed by the authors (stippled line) and important localities in the Annapurna-Dhaulagiri region (names corresponding with the numbers in circles are given in Appendix II). 1. Subtropical wet and dry forest and cultivated zone, 2. Wet oak forest *(Quercus lamellosa, Q. semecarpifolia)*, 3. Dry oak forest *(Quercus lanuginosa)*, 4. Rhododendron-Fir-Birch forest, 5. Wet alpine meadows, 6. Dry alpine meadows, 7. Wet and dry coniferous forest *(Picea, Pinus)*, 8. Broadleaved trees-Pine forest, 9. High altitude steppe, 10. Nival zone and snow.

Dhaulagiri Himal (Jaljala Pass) in the east, and are characterized by coniferous forests of *Picea smithiana, Pinus excelsa* and *Juniperus indica*. In the Sikkim Himalayas, which extend from the Dhaulagiri Himal in the west to Bhutan in the east, the amount of precipitation is higher than in the Garhwal Himalayas and the montane forests are dominated by oaks (*Quercus lamellosa*) (see also climate and vegetation).

CLIMATE AND VEGETATION

The Annapurna region is a rather unique part of the Himalayas, because of the contrast between the northern and the southern sides. The upper reaches of the Kali Gandaki Valley on the northern side are a continuation of the Tibetan Plateau. This area is in the rainshadow of the Annapurna Himal and consequently it receives a very low amount of precipitation (annual precipitation at Jomosom 264 mm). Because of the enormous difference in altitude over short linear distances on the southern side of this mountain range, clouds develop all over the year and make this side one of the wettest in Nepal (annual precipitation at Lumle at 1700 m is 6100 mm). The total effective precipitation is probably even higher, because of the fog (Dierl & Gruber, 1979). Going east the area becomes drier (east of the Manaslu Himal) to become wetter again in eastern Nepal. The influence of the monsoon diminishes to the west. Consequently, the southern side of the Annapurna is too wet for its longitude. Nowhere is the contrast as immense as in the Kali Gandaki Gorge, because this valley crosses the main Himalayan chain. To a lesser extent the same is true for the Marsyandi Valley, but here clouds are able to intrude rather far to the north, because of the northwest direction of the valley.

The contrasts in humidity and temperature are reflected in the vegetation; a description of the main vegetation types, mainly derived from Dobremez & Jest (1971), follows below (fig. 3).

1. Subtropical wet and dry forest and cultivated zone.

The original vegetation of this zone consisted of tropical and subtropical wet forest of *Shorea robusta, Castanopsis indica, Schima wallichii* and *Engelhardtia spicata*. Unfortunately there is not much left of these forests. Most of the area is highly cultivated; terrace cultivation of maize, rice and vegetables. Remainders of the forest are to be found on steep slopes and occasionally along rivers (riverine forest of *Alnus nepalensis* and *Pandanus*).

Cultivation continues up to an altitude of about 2000 m on the southern side of the Himalayas. Deforestation is the most serious problem in this area, often leading to erosion and land-slides. In the Kali Gandaki and Marsyandi Valleys cultivation is limited to rather small areas, but is still possible up to an altitude of 3800 m (Muktinath).

South of the Dhaulagiri another type of forest exists, namely dry conifer forest of *Pinus roxburghii*. This type of forest is very common farther east, between the Manaslu Himal and the Arun Valley. It probably has developed by slash and burn activities of mankind during many centuries.

2. Wet oak forest.

Another term applied to this forest type is cloud forest, because of clouds accumulating above 2000 m. The forest mainly consists of *Quercus lamellosa* and other oaks. Because of the high humidity the trees and branches are covered with many epiphytes among which mosses play an important role. The humid *Q. lamellosa* forest is typical for Eastern Nepal and Sikkim. Only small patches occur in Central Nepal east of the Manaslu Himal. Near highly populated valleys deforestation at lower altitudes is enormous because of wood- and leaf-cutting, and cattle grazing. The secondary forest resulting is rather open, consisting of many Lauraceae. Pastures and high humidity form an ideal combination for millions of leeches.

At about 2400 m *Q. lamellosa* is replaced by *Quercus semicarpifolia* and *Rhododendron arboreum*. This high altitude type of oak forest also exists on the southern side of the Dhaulagiri, but at lower altitude the area is drier and another type of oak forest exists.

3. Dry oak forest.

The area south of the Dhaulagiri is drier than the area south of the Annapurna. Here the original vegetation above 2000 m is dry oak forest, of which only small parts are left. It is a rather open type of forest dominated by *Quercus lanigunosa*.

4. Rhododendron-Fir-Birch forest.

A forest consisting of *Abies spectabilis, Betula utilis* and *Rhododendron campanulatum*. It is the highest occurring type of forest in this part of the Himalayas. It replaces the oak forest at an altitude of about 3300 m and continues up to the timberline at about 3900 m south of the Annapurna and Dhaulagiri. North of the Annapurna the timberline even lies at an altitude of 4200 m. The tree most resistant to cold here, is *B. utilis*. The undergrowth is very poor, only some man-made pastures having a more varied herbaceous vegetation.

5. Wet alpine meadows.

The permanent snowline lies between 5200 and 5800 m (Dierl & Gruber, 1979). The alpine meadows below the snowline are very rich from a floristic point of view, with several arcto-alpine genera: *Gentiana, Primula, Saxifraga, Polygonum.* Only in high summer these meadows are used as pastures for cattle.

6. Dry alpine meadows.

In the Annapurna-Dhaulagiri region these are only found above circa 4400 m north of the Dhaulagiri and in the upper reaches of the Kali Gandaki. The main plants in these meadows are small species of *Rhododendron, Juniperus squamata, Lonicera myrtillus* and *Potentilla fructosa.* Because of the low amount of precipitation, the duration of snow coverage probably is less than on the southern side of the mountains (see Matthiessen, 1978). The border between this zone and the lower high altitude steppe (9) is rather artificial.

7. Wet and dry coniferous forest.

In the valley of Uttar Ganga (Dhorpatan) this forest consists of *Pinus excelsa* and *Juniperus indica.* In the upper reaches of the Marsyandi the same type of forest occurs, but much drier and more open. Here the transition to a wetter type of forest, consisting of *Picea smithiana* and *Tsuga dumosa,* in the southeast is rather abrupt, because of a sharp angle in the course of the valley. The forest here discussed is rather unique for the longitude of the Marsyandi; other known localities are all west of the Dhaulagiri, in the part called the Garhwal Himalayas. In the middle reaches of the Kali Gandaki, pure *P. excelsa* forests are dominant. North of Tukche some stands of *Cupressus torulosa* can be found higher up the slopes. Usually the borders of all these conifer forests are rather distinct. Only in the Kali Gandaki Valley there is a transitional zone with the broadleaved trees in the south.

8. Broadleaved trees-Pine forests.

Transitional zone between 2 and 7.

9. High altitude steppe.

This is a continuation of the vegetation of the Tibetan Plateau. In the Annapurna-Dhaulagiri area it is only found north of the Dhaulagiri (Dolpo) and north of Jomosom, where the valley floor of the Kali Gandaki is rather wide and flat (Thak Khola Valley). The vegetation of the high altitude steppe is dominated by *Sophora moorcroftiana* and *Oxytropis cericopetala.* Higher up on the slopes a steppe consisting of *Caragana* species, *Potentilla fructicosa*

and some *Lonicera* species is found. Agriculture in this area is only possible with irrigation (potatoes and barley). Fire-wood is scarce and instead yak-dung and small branches of *Juniperus* are used as fuel. Some *Populus* trees, planted near the villages provide additional wood.

MATERIAL AND METHODS

A trek was made around the Annapurna Himal from April 4, 1981 till June 3, 1981, and another along the southern side of the Dhaulagiri Himal from July 1, 1981 till July 27, 1981. During these treks a small collection of reptiles and amphibians was assembled.

All data on herpetofauna previously collected in this area have been gathered from the literature, except for the still unpublished collections made by Gruber (Munich) in 1973 and 1979 and a collection of Hyatt (London) from 1954, which is still partly unpublished. The Gruber collection was seen by Ouboter. Of the Hyatt collection only the species which are difficult to recognize were seen. Specimens of this collection not examined but whose identification is unlikely to be wrong are indicated by an asterisk *.

The data collected are presented in the following sequence:

- Material examined: mainly specimens collected by us in 1981; part of the specimens remained in the Natural History Museum in Swayambhu, Nepal. These are indicated by field no. RMNH (Nepal). Also examined specimens of the Gruber and Hyatt collections.
- Literature references.
- Field observations: specimens sighted by us (but not collected) of which the identification was certain. They are indicated by the letter S, followed by a serial number.

The following museums are mentioned:

BMNH – British Museum (Natural History), London.
FMNH – Field Museum of Natural History, Chicago.
MCZ – Museum of Comparative Zoology, Harvard.
MHNG – Muséum d'Histoire Naturelle de Genève.
MNHNP – Muséum National d'Histoire Naturelle, Paris.
RMNH – Rijksmuseum van Natuurlijke Historie, Leiden.
SMF – Senckenberg Museum, Frankfurt.
ZSM – Zoologische Staatssammlung, München.

The specimens collected by Dubois, which are listed under several numbers (usually an abbreviation of the specific name), are preserved in the Muséum National d'Histoire Naturelle in Paris.

The localities are listed (in alphabetical order) and their exact position is explained in Appendix I. Important localities are indicated by numbers in fig. 3 (also see Appendix I and II).

Synonyms of species are only given if they can be found in literature concerning the reptiles and amphibians of the Himalayas or when the synonym was in use after 1930. References refering to the present name are given when they concern Nepalese localities.

The diagnoses are based on both the literature and our own observations.

REPTILIA

Sauria

Key to the families of lizards in the Annapurna-Dhaulagiri area.

1. Pupil vertical; eyes without movable lids, covered with a transparent membrane; digits dilated; no imbricate scales ..... Gekkonidae
– Pupil not vertical; eyes with movable, untransparent lids, sometimes a small transparent window in the lower eyelid; digits not dilated; scales imbricate 2
2. Scales clearly keeled, without osteodermal plates; head with symmetrical shields above; tongue smooth or covered with villose papillae ..... Agamidae
– Scales not or only slightly keeled, with osteodermal plates; no symmetrical shields on top of the head; tongue with imbricate, scale-like papillae ..... Scincidae

Gekkonidae

Key to the species of gekkonid lizards in the Annapurna-Dhaulagiri area.

1. Dorsal tubercles large and numerous, arranged in quite regular longitudinal series; 7 to 10 lamellae under the fourth toe ..... *Hemidactylus brookii*
– Dorsal tubercles granular or only enlarged on the tail, not regularly arranged; 11 to 14 lamellae under the fourth toe 2
2. Tail without denticulated lateral edge, with enlarged tubercles above, swollen at the base in adults ..... *Hemidactylus flaviviridis*

– Tail strongly depressed, with sharp denticulated lateral edge, with uniform small granules above, not swollen at the base .... *Hemidactylus garnotii*

Hemidactylus brookii Gray, 1845

Hemidactylus brookii Gray, 1845: 153 (type loc. Borneo).
Hemidactylus brooki – Smith, 1935: 89; Swan & Leviton, 1962: 139; Majupuria, 1981: 155.

Material examined. — Pokhara airport, 960 m: 2♂, RMNH 20471-72, 4-IV-1981, 1 ex., field no. RMNH 0651 (Nepal), 27-VII-1981, all leg. L. Nanhoe & P.E. Ouboter.

Diagnosis. — A medium-sized gekkonid lizard (snout-vent length about 58 mm) with numerous large dorsal tubercles. Digits free; 7-10 lamellae under the fourth toe. Dorsally light brown or grey with dark brown spots, usually more or less regularly arranged; a dark streak along the side of the head.

Habitat. — Usually on and in buildings, rarely on trees in gardens.

Distribution. — A Panoriental species. Range: Pakistan, Nepal, India, Sri Lanka, southern Burma and Indonesia. In Nepal common in Kathmandu and Pokhara and also reported from the Terai. No hill or mountain localities are known. An unidentified gecko observed by us in a house at Birethanti (about 16 km west of Pokhara), probably belonged to this species and may have reached this place with porter loads from Pokhara.

Hemidactylus flaviviridis Rüppell, 1840

Hemidactylus flaviviridis Rüppell, 1840: 18 (type loc. Massaua Island, Eritrea); Smith, 1935: 98; Swan & Leviton, 1962: 139; Majupuria, 1981: 154.

Material examined. — Pokhara airport, 960 m: 1♀, 1♂, RMNH 20477-78, 27-VII-1981, leg. L. Nanhoe & P.E. Ouboter.

Diagnosis. — A large gekkonid lizard (snout-vent length about 90 mm) with enlarged tubercles only on the dorsal side of the tail. Eleven to 14 lamellae under the fourth toe. Tail swollen at the base. Male with 5-7 femoral pores on each side separated by at least six scales. Dorsally grey with indistinct transverse bands.

Habitat. — The only known locality in central Nepal is a small hotel (at Pokhara airport), where they were seen near lamps on the walls of the main building and several annexes.

Distribution. — An Arabian and Indian species. Range: The Arabian Peninsula, Iran, Afghanistan, Pakistan, Northern India, Southern and Central Nepal. It probably reached Pokhara Valley in Nepal recently with road-transports from India or the Terai. In the Terai it is recorded from Butwal, south of Pokhara (Majupuria, 1981). The owner of the hotel in Pokhara, where *H. flaviviridis* was recorded in July 1981, only had seen this lizard (recognizable by its size) during the preceding few months. It was not observed, neither by Ouboter and Van Meeuwen during their visit to the hotel in 1978, nor by us during our first visit in the beginning of April 1981.

Hemidactylus garnotii Duméril & Bibron, 1836

Hemidactylus garnotii Duméril & Bibron, 1836: 368 (type loc. Tahiti).
Hemidactylus (Doryura) mandellianus Stoliczka, 1872a: 101.
Hemidactylus blanfordi Boulenger, 1885: 141; Boulenger, 1890: 95.
Hemidactylus garnoti – Smith, 1935: 100; Swan & Leviton, 1962: 139.

Material examined. — Pokhara, 940 m: 1♀, BMNH 1955.1.13.19, 10-V-1954, leg. K.H. Hyatt. Pokhara airport, 960 m: 1♀, RMNH 20476, 2-VII-1981, 2 ex., field no. RMNH 0649-50 (Nepal), 2-VII-1981, all leg. L. Nanhoe & P.E. Ouboter.

Diagnosis. — A medium-sized gekkonid lizard (snout-vent length about 65 mm) with uniform small granules on the back. Outer pair of postmentals normally not in contact with the infralabials. Tail strongly depressed with a sharp denticulated lateral edge and uniform small scales above. Dorsum greyish brown, speckled or indistinctly marbled with darker brown. A dark streak along the side of the head. Male unknown.

Habitat. — The specimens collected by us were found on lamps in the garden of a hotel.

Distribution. — A species with an Indo-Chinese distribution. Range: Central Nepal, Sikkim/Darjeeling, Burma, Indo-China, Indonesia, Oceania. The most western locality recorded up to now was Sikkim (Smith, 1935), which is about 450 km to the east of Pokhara. This species, however, was already collected in Pokhara in 1954 by Hyatt.

Agamidae

Key to the species of agamid lizards in the Annapurna-Dhaulagiri area.

1. Tympanum absent or, if present, covered with skin; body depressed. Dry

regions north of the main Himalayan chain .....
..... *Phrynocephalus theobaldi*
– Tympanum exposed 2
2. Body depressed. Usually found on rocks ..... *Agama tuberculata*
– Body not depressed 3
3. Dorsal scales of equal size, regularly arranged. Usually found in cultivated terrain ..... *Calotes versicolor*
– Dorsal scales unequal, heterogeneous 4
4. A prominent crest of 6-8 conical scales on each side of the back of the head; ventral scales nearly as large as the large dorsals. Oak and rhododendron forests ..... *Japalura tricarinata*
– No prominent crest; ventral scales smaller than the largest dorsals. Coniferous and rhododendron forests ..... *Japalura major*

Agama tuberculata Hardwicke & Gray, 1828
(fig. 4)

Agama tuberculata Hardwicke & Gray, 1828: 218 (type loc. "Bengal"). Annandale, 1907a: 154; Smith, 1935: 214; Smith, 1951: 728; Smith & Battersby, 1953: 703; Swan & Leviton, 1962: 110; Dierl & Gruber, 1979: 45; Majupuria, 1981: 153.
Barycephalus sykesii Günther, 1860: 150.
Stellio tuberculatus – Günther, 1864: 157; Steindacher, 1867: 22; Stoliczka, 1872a: 115.
Stellio dayanus Stoliczka, 1871: 194; Stoliczka, 1872a: 113.
Agama dayana – Boulenger, 1885: 362; Boulenger, 1890: 148.

Material examined. — Lumsum, 1980 m: 1 subadult, 1 juv., BMNH 1955.1.13.29-30*, 12/14-VII-1955, leg. K.H. Hyatt. Muna, 2180 m: 1♀, RMNH 20483, 9-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 1 km N of Darwang, 1200 m: 1♂, field no. RMNH 0556 (Nepal), 7-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Beni, 850 m: 1 adult, BMNH 1955.1.13.31*, 13-VI-1954, leg. K.H. Hyatt. Tatopani, 1550 m: 2 ex., ZSM 85/1973, 28-V-1973, leg. U. Gruber & D. Fuchs. Dana-Ghasa, 1600-2000 m: 4 ex., ZSM 86/1973, 29-V-1973, leg. U. Gruber & D. Fuchs. Kalopani, 2500-2600 m: 1 ex., ZSM 88/1973, 31-V-1973, 4 ex., ZSM 89/1973, 10-VI-1973, 2 ex., ZSM 90/1973, 10-VI-1973, all leg. U. Gruber & D. Fuchs. Tukche, 2560 m: 8 ex., ZSM 91/1973, 19-VI-1973, 11 ex., ZSM 92/1973, 23-VI-1973, all leg. U. Gruber & D. Fuchs. Choklopani, 2600 m: 1 juv., RMNH 20482, 19-V-1981, leg. L. Nanhoe & P.E. Ouboter. Tukche - Jomosom, 2700 m: 3 ex., ZSM 8/1975, VII-1973, leg. U. Gruber & D. Fuchs. Marpha, 2800-3000 m: 3 ex., ZSM 93/1973, 23-VI-1973, leg. U. Gruber & D. Fuchs. Marpha - Shiang, 3400 m: 3 ex., ZSM 98/1973, 16-VII-1973, leg. U. Gruber & D. Fuchs. Jomosom, 2750 m: 6 ex., ZSM 94/1973, 30-VI-1973, 3 ex., ZSM 96/1973, 15-VII-1973, all leg. U. Gruber & D. Fuchs. Jomosom - Tilicho Tal, 3310 m: 1 ex., ZSM 95/1973, 1-VII-1973; 3300 m: 1 ex., ZSM 97/1973, 15-VII-1973, both leg. U. Gruber & D. Fuchs. Gandrung forest, 2250 m: 5 ex., ZSM 82/1973, 12-V-1973, 1 ex., ZSM 83/1973, 15-V-1973, 14 ex., ZSM 84/1973, 23-V-1973, all leg. U. Gruber & D. Fuchs. Gandrung, 2100 m: 7 ex., ZSM 87/1973, 23-V-1973, leg. U. Gruber & D. Fuchs; 1900 m: 3 ex., ZSM 7/1975, 11-III-1974, leg. U. Gruber; -, 3 ex., ZSM 148/1979, II/III-1977, leg. D. Fuchs. 1 km SE of Ghandrung, 1900 m: 1♂, RMNH 20481, 8-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Naudanda, 1550 m: 8 ex., ZSM 81/1973, 10-V-1973, leg. U. Gruber & D. Fuchs.

Field observations. — 3 km W of Lumsum, 2380 m: 1 adult, S 68, 25-VII-1981. Macchim, 2020 m: 1 adult, S 67, 8-VII-1981. 2 km NW of Siwang, 1800 m: 1 adult, S 65, 8-VII-1981. 1 km S of Dharapani, 1570 m: 1 adult, S 63, 7-VII-1981. Bhalebas - Ruksechara, 1550-1600 m: adults, S 40, 22-V-1981. Kopchepani, 1900 m: 1 adult, S 39, 22-V-1981. 0.5 km S of Taglung, 2560 m: 1 adult, S 38, 20-V-1981. Choklopani, 2600 m: adults, juveniles, S 36, 18-V-1981. Tirkhedhunge, 1580 m: 1 adult, S 49, 28-V-1981; 1590 m: 1 adult, S 82, 25-VII-1981. 1-2 km N of Ghandrung, 1940-2000 m: population, S 5, 8-IV-1981. 1 km W of Suikhet, 1100 m: 1 adult, S 2, 5-IV-1981. 4 km NW of Khudi, 820 m: 1 adult, S 22, 30-IV-1981. Khudi, 790 m: adults, S 24, 30-IV-1981. Bhulebhule - Nayagaon, 810 M: 1 adult, S 25, 1-V-1981. Syang, Marsyandi, 1140 m: 1 adult, S 28, 2-V-1981. Chamce, 1340 m: 1 adult, S 31, 2-V-1981. Kura (W of Tal), 2010 m: 1 adult. S 32, 3-V-1981. Thonje, 1910 m: 1 adult, S 33, 4-V-1981.

Diagnosis. — A medium- to large-sized agamid lizard (snout-vent length about 140 mm). Body depressed. Enlarged dorsals keeled, about as large as the ventrals; flanks with a few enlarged scales. Back dark brown to black with irregularly arranged yellow spots; head, limbs and tail brown; ventral parts yellowish-white. In males the throat with a greyish black reticulated pattern. Juveniles dorsally greyish without yellow spots.

Habitat. — This species is characteristic for open, rocky areas, mostly along rivers. Since most of the foothpaths are along these rivers, one might be tempted to call *A. tuberculata* a perianthropic species. This is probably not correct; we found several specimens far from human settlements and paths

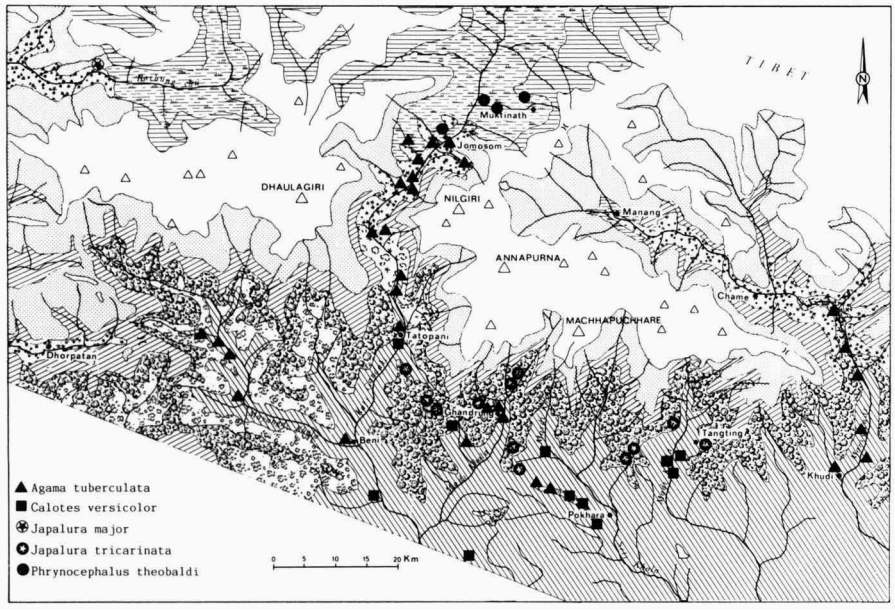

Fig. 4. Distribution of the Agamidae. Legend see fig. 3.

(e.g. Syang and on land-slides). The habitat of this species is restricted to the driest and warmest localities present in the area. It is the easternmost living representative of the genus *Agama*, which comprises only species which have very high temperature preferences. *A. tuberculata* has a wide altitudinal distribution: 790-2250 m at the southern side of the Annapurna Himal, where it does not occur in or above the forests. At the drier northern side of the Annapurna Himal the highest recorded locality is at 3400 m (see Zoogeographical and altitudinal analysis and discussion).

Juveniles were seen in May only, in the upper reaches of the Kali Gandaki. According to Smith (1935) it breeds from May to July.

Distribution. — See fig. 4. A Western Himalayan species. Range: northeastern Afghanistan, northern Pakistan (Chitral), Kashmir and the Himalayan regions of Himachal Pradesh and Uttar Pradesh, western and central Nepal. *A. tuberculata* ranges farther east than most Western Himalayan species. The most eastern locality recorded is Chitlong (just south of Kathmandu Valley) (Annandale, 1907a). At this eastern distribution limit it is known from a small number of localities only. It has not yet been recorded from the Kathmandu Valley. In the Annapurna-Dhaulagiri area and west of it, this species is very common. In the study area it follows the course of the Kali Gandaki up to the oasis of Jomosom. North of this place the area becomes drier and *A. tuberculata* has not been found there so far. The sand- and gravel-plains of this area are the habitat of another species: *Phrynocephalus theobaldi*. *A. tuberculata* is not found in the Manang Valley. Maybe the dense forests between Chame and Pisang form a barrier for this heliotherm species.

Calotes versicolor (Daudin, 1802)
(fig. 4)

Agama versicolor Daudin, 1802: 395 (type loc. India).
Calotes versicolor – Annandale, 1907a: 153; Smith, 1935: 189; Smith, 1951: 728; Smith & Battersby, 1953: 703; Leviton, Myers & Swan, 1956: 10; Swan & Leviton, 1962: 110; Acharji, 1961: 239; Majupuria, 1981: 153.

Material examined. — Tatopani, 1550 m: 1 ex., ZSM 61/1973, 29-V-1973, leg. U. Gruber & D. Fuchs. Dhilijung Dunga (Ulleri), 1500 m: 2 ex., ZSM 62/1973, 21-VII-1973, leg. U. Gruber & D. Fuchs. Indi Khola (Luwang), 1360 m: 2♂, RMNH 20484-85, 19-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Pokhara - Naudanda, 960-1500 m: 1 ex., ZSM 150/1979, 25-II-1977, leg. D. Fuchs. Suikhet - Pokhara, 960-1210 m: 2 ex., ZSM 151/1979, 4-III-1979, leg. D. Fuchs. 3.5 km N of Namarjang, 1350 m: 1♀, RMNH 20486, 24-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Field observations. — Baglung, 880 m: 1 adult, S 59, 5-VII-1981. Tatopani, 1200 m: 1 adult, S 41, 23-V-1981. 0.5 km S of Karkineta, 1620 m: 1♀, S 55, 2-VII-1981. Phewa Tal - Pokhara,

960 m: males, S 1, 3-IV-1981. 2 km NW of Taprang, 1660 m: 1♂, S 15, 22-IV-1981. Madi Khola (below Thak), 920 m: males, S 16, 23-IV-1981. Namarjang, 1070 m: 1♂, S 18, 24-IV-1981.

Diagnosis. — A medium-sized lizard (snout-vent length about 80 mm). Body compressed. Two separated spines above the tympanum. Thirty five to 52 scales round the body; dorsal scales rather large, more or less distinctly keeled, all pointing backwards and upwards. Nuchal and dorsal crest continuous and well developed in males; in adult males cheeks swollen. Colour in life light brown or grey on the dorsum, sometimes with dark brown transverse spots or bars upon the back and lateral parts. During the breeding season males may show a scarlet head and shoulders.

Habitat. — This species is restricted to cultivated land and is never found inside the forests, not even in clearings. The highest known locality in Nepal, 1660 m, is in a highly deforested area (Taprang), where it lives up to the edge of the forest. *Calotes versicolor* is found active on the ground or in bushes, along the paths or in villages; only occasionally in trees. In this respect, the habitat is clearly separated from the habitat of *Agama tuberculata,* which inhabits rocky areas. Only in places where *A. tuberculata* is absent (e.g. Madi Khola) *C. versicolor* occupies its niche, and red-headed instead of blue-headed lizards can be seen on the rocks.

Juveniles were never observed by us. In the beginning of May some subadult animals were seen and in July a pregnant female. In September 1978 Ouboter saw several juveniles in the Kathmandu Valley.

Distribution. — See fig. 4. A Panoriental species. Range: Afghanistan, Pakistan, India, Nepal, Sikkim, Sri Lanka, Andaman Islands, southern China, northern part of the Malay Peninsula, Sumatra. In Nepal this species is restricted to cultivated land on the southern side of the main Himalayan range, a typical characteristic of most Panoriental species (see Zoogeographical and altitudinal analysis and discussion).

Japalura major (Jerdon, 1870)
(fig. 4)

Oriocalotes major Jerdon, 1870: 77 (type loc. near Kotgarh, W. Himalayas).
Acanthosaura major – Boulenger, 1885: 306; Boulenger, 1890: 128; Annandale, 1907a: 152; Annandale, 1914: 320; Hora, 1926: 218.
Japalura major – Smith, 1935: 171; Smith & Battersby, 1953: 703; Swan & Leviton, 1962: 111; Majupuria, 1981: 153.

Literature reference. — Kakkotgaon, Barbung Khola, 3650 m: 1 or more ex., BMNH -, 1952, leg. O. Polunin (Smith & Battersby, 1953).

Diagnosis. — A medium-sized agamid lizard (snout-vent length about 85 mm). Body feebly compressed. Tympanum naked. No prominent crest on the back or the head. Occiput with a variable number of spinose scales, not arranged in a curved series as in *J. tricarinata*. Dorsal scales very unequal, the larger ones are often disposed in vertical series on the sides of the body. A transverse gular fold covered with small scales is present. Dorsally greyish brown with dark brown triangular or V-shaped markings upon the back and the base of the tail. Top of the head with dark cross-bars.

Habitat. — All known localities are in the Western Himalayas, in places where the original vegetation consists of rhododendron and coniferous forests, but no exact data on the habitat are available.

Distribution. — See fig. 4. A Western Himalayan species. Range: Himachal Pradesh, western Nepal. Not recorded by us, not even from the Dhorpatan area, where it might have been expected, since this area is west of the Jaljala Pass and already belongs to the Garhwal Himalayas.

Japalura tricarinata (Blyth, 1854)
(fig. 4)

Calotes tricarinatus Blyth, 1854: 650 (type loc. Sikkim).
Tiaris ellioti Günther, 1860: 151.
Oriotiaris ellioti – Günther, 1864: 150; Jerdon, 1870: 77.
Oriotiaris tricarinata – Anderson, 1871b: 167.
Charasia (Oriotiaris) tricarinata – Stoliczka, 1872a: 112.
Acanthosaura tricarinata – Boulenger, 1885: 306; Boulenger, 1890: 129; Annandale, 1907a: 153; Hora, 1926: 218.
Japalura tricarinata – Smith, 1935: 169; Smith, 1951: 728; Swan & Leviton, 1962: 111; Dierl & Gruber, 1979: 42.

Material examined. — Sikha, 2440 m: 2 juv., BMNH 1955.1.13.21-22, 21/28-V-1954, 2♂, BMNH 1955.1.13.23-24, 21/28-V-1954, 1♀, 1♂, BMNH 1955.1.13.26-27, 21/28-V-1954, all leg. K.H. Hyatt. Ghorapani, 2850 m: 2♀, 3♂, 1 juv., RMNH 20493-98, 23/26-V-1981, 1♀, 1♂, field no. RMNH 0630, 0632 (Nepal), 26-V-1981, all leg. L. Nanhoe & P.E. Ouboter. Ulleri, 1830-2130 m: 1 juv., BMNH 1955.1.13.20, 19-V-1954, leg. K.H. Hyatt. Gandrung forest, 2400 m: 5♀, 1♂, ZSM 58/1973, 14/22-V-1973, leg. U. Gruber & D. Fuchs. S slope of Chumro Khola, 2000 m: 1♀, 1♂, RMNH 20488-89, 9-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Kuldigar (Modi Khola), 2450 m: 1 juv., ZSM 59/1973, 20-V-1973, leg. U. Gruber & D. Fuchs. 2 km NW of Dhampus forest, 2130 m: 1 juv., RMNH 20487, 6-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Dhampus forest, 2030 m: 1♀, 1♂, RMNH 20490-91, 17-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Bhurjung - Chipli Khola, 2370 m: 1♀, RMNH 20492, leg. L. Nanhoe & P.E. Ouboter. Chipli, 2130-2440 m: 1♂, BMNH 1955.1.13.25, 18-IV-1954, leg. K.H. Hyatt. Siklis, 2740 m: 1♀, BMNH 1955.1.13.28, 20-VIII-1954, leg. K.H. Hyatt.
Field observations. — Tang Ting forest, 2070 m: 1 juv., S 20, 25-IV-1981.

Diagnosis. — A small agamid lizard (snout-vent length about 50 mm in

females and 40 mm in males). Body not compressed but cylindrical. Tympanum exposed. A prominent crest of 6 conical scales on each side of the back of the head. Dorsal scales very unequal, the larger ones strongly keeled; they form parallel rows on either side of the vertebral row and transverse V-shaped rows on the back and the flanks. No nuchal or dorsal crest, but the vertebral row of scales distinctly enlarged. Males in life bright-green, except for the ventral parts, which are white and brownish around the vent. A distinct black stripe from the eye to the angle of the jaws; this stripe is edged by a white stripe below. Sometimes a black and white dorsolateral stripe from the back of the head to just above the forelimbs. Females vary much in colour, but are dorsally always brown. Parallel rows of enlarged scales are usually lighter or darker brown than the rest of the back. In one female specimen from the forest above Bhurjung Khola the total area between the dorso-lateral enlarged scales-rows was light brown. Ventral parts yellowish brown to grey with or without brown spots. A brown to dark brown band on the top of the head connecting the eyes. Juveniles resemble the females.

Habitat. — This species is only found in the wet monsoon and rhododendron forests between about 2000 and 2850 m. Gruber collected it deep inside the forests (Gruber, 1975; Dierl & Gruber, 1979). He is of the opinion that it is an arboreal species of which mainly females are found in spring, when they come to the forest floor to lay their eggs (Gruber, 1975). Our observations do not support this idea since most specimens were found in forest clearings, usually basking on the ground or in small bushes. It was very difficult to locate the males between the green herbs. All efforts to locate specimens up in trees remained fruitless, possibly because of the camouflage of this species or, more likely, because they simply do not live there. Stoliczka (1872a) also found most specimens on the ground "about large stones in sunny places on the scarp of the road".

Gruber (1975) stated that specimens of this species occupy a large area, but that they can be kept together in captivity, because they lack any social behaviour. In Ghorapani I found ten specimens in an area less than half a hectare, but in captivity, though lacking distinct displays, males chased each other constantly. Of three males living in a cage of about 1/8 m^2, only one survived after three weeks.

Juveniles were found in early and in late April.

Distribution. — See fig. 4. An Eastern Himalayan species. Range: central and eastern Nepal, Sikkim/Darjeeling. Not found west of Jaljala Pass, where it is probably replaced by *Japalura major* (see Smith & Battersby, 1953). Between the Annapurna and Sikkim/Darjeeling *J. tricarinata* is only found sporadically (Annandale, 1907a; Smith, 1951). The reason for this could be

that only few collections have been made in this area, but it is also possible that the drier environment makes this area less suitable for *J. tricarinata*. The same disjunct distribution is found in other humidity loving Eastern Himalayan species, like *Scutiger sikimmensis* and *Scincella sikimmensis*. In the Annapurna area *J. tricarinata* is restricted to the wet oak forests south of the main Himalayan range.

Phrynocephalus theobaldi Blyth, 1863
(figs. 4, 5)

Phrynocephalus theobaldi Blyth, 1863: 90 (type loc. Lake Tshomarari, Rupshu Province, Tibet); Smith, 1935: 230; Swan & Leviton, 1962: 138.
Phrynocephalus stoliczkai Steindachner, 1867: 23.
Phrynocephalus caudivovulus Anderson, 1872: 387.

Material examined. — Jomosom, 2890 m: 1♀, BMNH 1955.1.13.32*, 9-IX-1954, leg. K.H. Hyatt; 2890 m: adults, (Nepal), 15-VII-1977, leg. H.S. Nepali. Kagbeni (above), 3200 m: 3 ex., BMNH -, 1980, leg. U. Gruber. Kagbeni - Muktinath, 3200 m: 11 ex., BMNH -, 1979, leg. U. Gruber. 3 km N of Jhong, 3830 m: 1♀, 1♂, RMNH 20499-204500, 13-V-1981, 1♀, RMNH 20501, 15-V-1981, leg. L. Nanhoe & P.E. Ouboter.
Field observations. — 2 km SE of Kagbeni, 3060 m: 1 adult, S 35, 16-V-1981. 3 km N of Jhong, 4000 m: adults, 15-V-1981.

Diagnosis. — A small agamid lizard (snout-vent length about 54 mm). Body depressed. Tympanum absent or concealed. Eyelid thick, strongly projecting. Dorsal scales subequal, homogeneous. Nasal shields large, usually separated from one another by three scales. No spinous tubercles upon the neck or back of the head. Dorsally grey speckled with black, white and brown. Tail rounded; the tip rather blunt. In males the tip of the tail intense black, in females grey. All specimens collected in May 1981 had a large black patch on the belly, which is not mentioned by Smith (1935) and possibly only occurs seasonally.

Habitat. — In the area studied, this species only occurs in the high altitude steppe of the upper reaches of the Thak Khola (north of Jomosom). The lizards were numerous on a gently sloping plain north of Jhong at an altitude of 3800-4000 m, the soil consisting of rough sand and occasionally larger stones. Vegetation was sparse. In an area of 0.5 hectare we found eight burrows occupied by this species. When approaching a certain burrow, situated under a bush, two specimens disappeared in it. All other burrows were under stones, and as far as we could establish, were occupied by one lizard only. At night-temperatures of about 8°C, lizards asleep under stones had body-temperatures of about 11°C. This population received sunshine relatively late (7 a.m.) due to the exposure of the area. It still took two hours before most

specimens started to come out of their burrows. First the head was warmed up in the sun. Then very slowly, spread over one or more hours the whole animal appeared out of its shelter. Their body-temperatures reached 20°C by then. They usually stayed near their burrow. Sitting on top of a nearby stone they watched the surroundings for insects, and made short excursions to catch some. When strong winds were blowing, they sought shelter in the lee of a stone and excursions became rare. During calm weather their preferred body-temperature measured by us was about 32°C (air-temperature 20°C). With strong winds blowing, the lizards probably could not reach this high temperature: the highest body-temperature measured then was 26°C (fig. 5).

Distribution. — See fig. 4. A Tibetan species. Range: southern Tibet, eastern Turkestan (Smith, 1935) and Ladakh (Gruber, 1981). The upper reaches of the Thak Khola is the only area where it is known to occur within the Nepalese borders. It was collected here for the first time by Hyatt in 1954 and in the seventies by Nepali and Gruber, but these records have not been published. This species is unlikely to be found further east in Nepal, since its

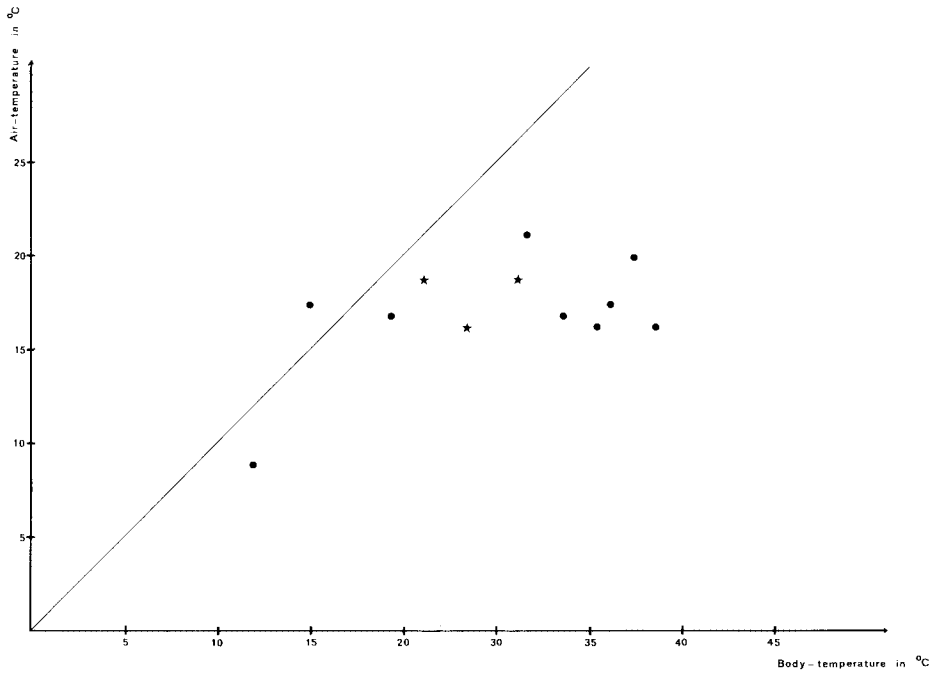

Fig. 5. Body-temperature of *Phrynocephalus theobaldi* related to the air-temperature in °C. Stars indicate temperatures measured with strong wind, dots indicate temperatures measured during calm weather.

preferred habitat does not occur there, but it still could be found further west, in Dolpo (north of the Dhaulagiri), an area that geographically belongs to the Tibetan Plateau.

Scincidae

Key to the species and subspecies of scincid lizards in the Annapurna-Dhaulagiri area.

1. Lower eyelid scaly; 38 or more scales around the body; no enlarged nuchals; rostral flat or concave. Usually found along rivers ..... *Sphenomorphus maculatus*
– Lower eyelid with a transparent window; less than 38 scales around the body; some pairs of enlarged nuchals; rostral convex 2
2. Frontal often touching the third supraocular; palpebral disc very large; ear with distinct projecting lobules on the anterior margin; ciliars thickened 3
– Frontal not touching the third supraocular; palpebral disc medium-sized; ear without distinct projecting lobules; ciliars not thickened 4
3. Large number of body scales: 71-90 gulars + ventrals, 30-38 scales around midbody; back usually grey, heavily spotted with black and white spots. Dry regions north of the main Himalayan chain ..... *Scincella ladacensis ladacensis*
– Smaller number of body scales: 57-75 gulars + ventrals, 24-30 (exceptionally 31 or 32) scales around midbody; back usually bronze-brown with black spots, sometimes with white spots as well. Coniferous forests and alpine meadows south of the main Himalayan chain ..... *Scincella ladacensis himalayana*
4. A relative large skink, mean snout-vent length 68 mm; 30-32 scales around midbody; head small, neck wider than head; ear very small, slit-shaped. Usually found in or near wet oak forests. *Scincella capitanea*
– A rather small skink, mean snout-vent length 39 mm; 21-29 scales around midbody; head of normal size, wider than neck; ear small, round. Usually found in clearings in wet oak forests ..... *Scincella sikimmensis*

Scincella capitanea Ouboter, 1986
(fig. 6)

Scincella capitanea Ouboter, 1986: 31 (type loc. 3 km W of Dhampus, 1850 m, Annapurna region, Central Nepal).

Material examined. — Gandrung, 2100 m; 1♀, ZSM 56/73, 24-V-1973, leg. U. Gruber. Lumle, 1550: 1♀, ZSM 130/82, 2-V-1979, leg. U. Gruber. Dhampus forest 1850 m: 1♀, RMNH 20464 (holotype), 29-V-1981, leg. P.E. Ouboter & L. Nanhoe, 1770 m: 1♂, RMNH 20462, 18-IV-1981, leg. Dhanbahadur Gurung, P.E. Ouboter & L. Nanhoe. Dhampus, 1400 m: 2♀, 1♂, 1 juv., ZSM 129/82, 16-III-1974, leg. U. Gruber. Tang Ting, 1680 m: 1♀, RMNH 20463, 24-IV-1981, leg. P.E. Ouboter & L. Nanhoe.

Diagnosis. — A very large and robust *Scincella,* with a maximum snout-vent length of 78.5 mm. Limbs well-developed. Transparent window medium sized. Head small; neck wider than head. Ciliars not thickened. Frontal touching the first two supraoculars. Only the fifth supralabial under the eye. Ear slit-shaped and very small, without distinct projecting lobules. Three to four pairs of enlarged nuchals. Thirty to 32 scales around the body. Dorsum greyish brown to light brown, usually with small, irregularly arranged, black spots. A lateral bronze-brown band with an irregular dorsal edge, distinct between the fore- and hindlimb. Ventral parts greyish or yellowish-white.

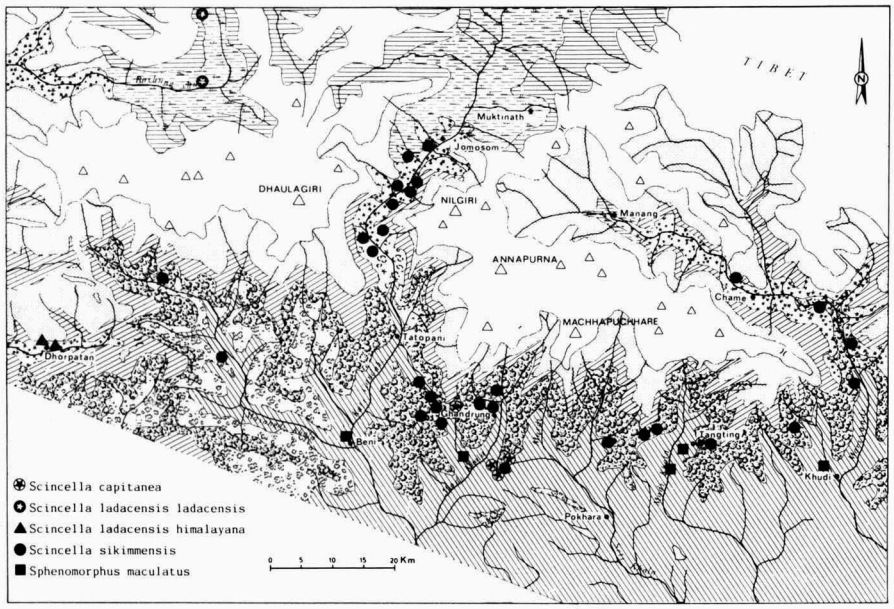

Fig. 6. Distribution of *Scincella* and *Sphenomorphus.* Legend see fig. 3.

Habitat. — Two specimens were collected in damp forests, but a third one was found underneath a stone on a bare field, quite distant from any forest at Tang Ting. A few years ago in 1978, when Ouboter and Van Meeuwen visited this place, there were some remains of forest in the neighbourhood. A specimen probably belonging to this species was seen more to the south near the Kali Gandaki Gorge, on a slope overgrown with bushes and ferns, also several hundred meters distant from forest. *S. capitanea* probably is a forest species, but it apparently manages to survive for some time when the forest is cut down.

Females collected in April and May contained eggs. Females collected in March showed no visible development of eggs.

Distribution. — See fig. 6. Only known from the area south of the Annapurna. It probably is a Himalayan endemic.

Scincella ladacensis ladacensis (Günther, 1864)
(fig. 6)

Eumeces ladacensis Günther, 1864: 88 (type loc. Ladakh); Anderson, 1872: 375.
Euprepes stoliczkai Steindachner, 1869: 45.
Euprepes kargilensis Steindachner, 1869: 46.
Mocoa stoliczkai – Theobald, 1876: 59; Blanford, 1878: 20.
Mocoa kargilensis – Theobald, 1876: 60.
Lygosoma ladacense – Boulenger, 1887a: 258; Boulenger, 1890: 201; Brongersma, 1935: 451.
Leiolopisma ladacense – Schmidt, 1926: 169; Smith, 1935: 300; Swan & Leviton, 1962: 111; Waltner, 1975b: 33; Majupuria, 1981: 156.
Lygosoma (Leiolopisma) ladacense – Constable, 1949: 103.
Leiolepisma ladacense – Smith & Battersby, 1953: 703.
Scincella ladacense – Minton, 1966: 105.
Scincella ladacensis – Greer, 1974: 7; Gruber, 1981: 148.
Scincella ladacensis ladacensis – Ouboter, 1986: 18.

Literature references. — Pemringgaon, Barbung Khola, 4880 m: 1♀, BMNH 1953.1.1.54, 1952, leg. Polunin, Sykes, Williams (Smith & Battersby, 1953). Kahajeng Khola, near Mohala Bhajang, Chharkabhot, 5490 m: 1♀, BMNH 1953.1.1.59, 17-VI-1952, leg. Polunin, Sykes, Williams (Smith & Battersby, 1953).

Diagnosis. — A robust *Scincella*; maximum snout-vent length 53.7 mm. A large transparent window in the lower eyelid. Ciliars distinctly thickened. Frontal touching the first three supraoculars. Only the fifth supralabial is situated under the eye. Ear slit-shaped; distinct projecting lobules on the anterior margin. Some pairs of enlarged nuchals present. Scales smooth; 30-38 around midbody. Dorsum grey to greenish brown and heavily spotted with black and white spots. A very dark brown lateral band and usually a greyish dorso-lateral stripe are present. Ventral parts greenish to blue.

Habitat. — The arid, high altitude steppes north of the Himalayas. Observations by Gruber (1981) in Ladakh indicate, that they occur in relatively wet places in this area, at the borders of irrigated, cultivated land. These areas are covered with sparse bushes and grass vegetation, the soil consists of rock-rubble. The specimen collected at the highest altitude (5490 m) was found in a spot where there were still many patches of snow (on June 17). The vegetation consisted of low scattered or dense bushes of *Lonicera rupicola* and *Caragana versicolor* with bare stony ground between them (Smith & Battersby, 1953).

This species is viviparous (Ouboter, 1986).

Distribution. — See fig. 6. Probably a Tibetan species, although it actually never has been collected from Tibet, but always from the area that is intermediate between the high Himalayas and the Tibetan Plateau (Ladakh and the northwestern regions of Nepal (Dolpo)), an area that receives a little more precipitation than Tibet. One would expect to find *S. l. ladacensis* around Muktinath (upper reaches of the Thak Khola), an area which resembles the area of Pemringgaon according to the habitat description given by Smith & Battersby (1953). However, no lizards could be located there. The area north of Muktinath, where *Phrynocephalus theobaldi* occurred, is probably too dry for this species. The eastern distribution limit of this lizard is, as far as is known, the northern spur of the Dhaulagiri Himal (Mukut Himal). In Nepal this subspecies is restricted to the Dolpo area (northwestern Nepal).

Scincella ladacensis himalayana (Günther, 1864)
(fig. 6)

Eumeces himalayanus Günther, 1864: 86 (type loc. Kashmir, Garhwal and Simla).
Euprepes blythi Steindachner, 1869: 46.
Mocoa himalayanus – Stoliczka, 1872a: 127.
Mocoa himalayana – Theobald, 1876: 57; Blanford, 1878: 19.
Mocoa blythii – Theobald, 1876: 59.
Lygosoma himalayanum – Boulenger, 1887a: 257; Boulenger, 1890: 200; Alcock, 1898: 36; Zugmayer, 1909: 488; Wall, 1911: 133; Hora, 1927: 4.
Leiolopisma himalayanum – Schmidt, 1926: 169; Smith, 1935: 299 (in part); Acharji & Kripalani, 1951: 181; Swan & Leviton, 1962: 111 (in part); Waltner, 1975b: 33; Majupuria, 1981: 156 (in part).
Lygosoma (Leiolopisma) himalayanum – Constable, 1949: 102.
Leiolepisma himalayanum – Smith & Battersby, 1953: 703.
Scincella himalayanum – Minton, 1966: 105; Sharma & Sharma, 1976: 51.
Leiolopisma (Scincella) himalayana – Mertens, 1969: 48.
Scincella himalayana – Greer, 1974: 7; Gruber, 1981: 48.
Scincella ladacensis himalayana – Ouboter, 1986: 21.

Material examined. — Dhorpatan, 2950-3440 m: 4♀, 4♂, RMNH 20445-52, 11/13-VII-1981, leg. P.E. Ouboter, L. Nanhoe & K.B. Shah.

Diagnosis. — As for *S. l. ladacensis*, from which it differs in the following characters: Limbs shorter and transparent window slightly smaller. Frontal usually touching the first three supraoculars, but sometimes only the first two. Twenty six to 30 (exceptionally 24, 25, 31 or 32) scales around midbody. Maximum snout-vent length 45.5 mm for specimens from Dhorpatan. Dorsum dark to bronze-brown, usually with small black spots. Dorso-lateral greyish stripe not always distinct. In spring the belly or the flanks and the subcaudal region may become orange to red.

Habitat. — This subspecies is abundant at Dhorpatan in a stony area with small bushes at the edge of *Pinus* forest. The specimen collected at 3440 m (RMNH 20451) was found in alpine meadows with some bushes. Most other Western Himalayan localities (see Ouboter, 1986) are in the area of coniferous forests and alpine meadows too. The highest record in the study area is at Dhorpatan at 3440 m, but probably occurring much higher as well (Jangla pass, see Matthiessen, 1978). In western Nepal the highest record is at 4880 m (see Ouboter, 1986).

Although this subspecies is reported to be viviparous by most previous authors, some populations apparently are oviparous (Gruber, 1981), including the Dhorpatan population where several clutches of eggs of this lizard were found under flat stones.

Distribution. — See fig. 6. A Western Himalayan species. Range: Pamir, northern Pakistan, Kashmir, Himachal Pradesh, Himalayan region of Uttar Pradesh, western Nepal. Not reported east of Jaljala Pass, where it is replaced by *S. sikimmensis*.

Scincella sikimmensis (Blyth, 1853)
(fig. 6)

Mocoa sikimmensis Blyth, 1853: 652 (type loc. Sikkim).
Tiliqua schlegelii Günther, 1860: 153.
Eumeces schlegelii – Günther, 1864: 86.
Eumeces sikimensis – Anderson, 1871b: 158.
Mocoa sacra Stoliczka, 1871: 195; Stoliczka, 1872a: 128; Theobald, 1876: 57; Annandale, 1910: 201.
Mocoa sikkimensis – Stoliczka, 1872a: 126; Theobald, 1876: 56.
Lygosoma sikkimense – Boulenger, 1887a: 257; Boulenger, 1890: 199; Annandale, 1907a: 154; Annandale, 1910: 201; Hora, 1927: 4.
Leiolopisma sikkimense – Smith, 1935: 301; Swan & Leviton, 1962: 111; Waltner, 1975b: 33; Majupuria, 1981: 156.

Lygosoma (Leiolopisma) sikkimense – Constable, 1949: 104.
Leiolepisma sikkimense – Smith, 1951: 728.
Scincella sikkimensis – Greer, 1974: 7.
Scincella sikimmensis – Ouboter, 1986: 24.

Material examined. — Gurjakhani, 2590 m: 3♀, BMNH 1955.1.13.36-38, 1954, leg. K.H. Hyatt. Siwang, 1780 m: 1 juv., RMNH 20444, 8-VIII-1981, leg. P.E. Ouboter & L. Nanhoe. Lete, 2450 m: 1♀, 1♂, RMNH 20438-39, 21-V-1981, leg. P.E. Ouboter & L. Nanhoe. Kalopani, 2500 m: 29 ex., ZSM 45/1973, 31-V-1973, 10 ex., ZSM 47/1973, VI/VII-1973, all leg. U. Gruber & D. Fuchs. Dhumpu (near Kalopani), 2700 m: 4 ex., ZSM 46/1973, 1-VI-1973, leg. U. Gruber & D. Fuchs. Taglung, 2900 m: 1 juv., BMNH 1955.1.13.68, 1954, leg. K.H. Hyatt. 1 km N of Taksang, 2870 m: 1 juv., RMNH 20437, 19-V-1981, leg. P.E. Ouboter & L. Nanhoe. Tassang (Taksang), 2880 m: 2 ex., ZSM 51/1973, 28-VI-1973, leg. U. Gruber & D. Fuchs. Choklopani, 2600 m: 1 ex., ZSM 49/1973, 22-VI-1973, leg U. Gruber & D. Fuchs. 3 km N of Choklopani, 2610 m: 1♀, 1♂, RMNH 20435-36, 17-V-1981, leg. P.E. Ouboter & L. Nanhoe. Tukuche, 2700 m: 2 ex., ZSM 50/1973, 23-VI-1973, leg. U. Gruber & D. Fuchs. Marpha (above), 3000 m: 3 ex., ZSM 48/1973, 23/24-VI-1973, leg. U. Gruber & D. Fuchs. Shyang, 2700 m: 1 ex., ZSM 52/1973, 29-VI-1973, leg. U. Gruber & D. Fuchs. Sikha, 2440 m: 8♀, 2♂, 2 juv., BMNH 1955.1.13.45-56, 1954, leg. K.H. Hyatt. 1 km NW of Ghorapani pass, 2750 m: 2♀, RMNH 20440-41, 25-V-1981, leg. P.E. Ouboter & L. Nanhoe. Poon Hill, SW of Ghorapani, 3000-3200 m: 2♀, RMNH 20442-43, 26-V-1981, 1♀, RMNH 20458, 24-VII-1981, all leg. P.E. Ouboter & L. Nanhoe. Ghorapani, 2800 m: 3 ex., ZSM 2/1974, III-1974, leg. U. Gruber. Ghorapani, 2850 m: 3♀, 1♂, RMNH 20453, 20455-57, 23/24-VII-1981, leg. P.E. Ouboter & L. Nanhoe. Ulleri, 1830-2130 m: 5 juv., BMNH 1955.1.13.63-67, 1954, leg. K.H. Hyatt. Gandrung forest, 2360 m: 4 ex., ZSM 42/1973, 12-V-1973, 20 ex., ZSM 43-44/1973, 15/16-V-1973, all leg. U. Gruber & D. Fuchs. Deorali (Gandrung), 2600 m: 1 ex., ZSM 53/1973, 1973, leg. U. Gruber & D. Fuchs. Chumro Khola, 1950 m: 1♀, 1♂, RMNH 20410-11, 12/13-IV-1981, leg. P.E. Ouboter & L. Nanhoe. Dhampus forest, 1990-2100 m: 1♀, 4♂, RMNH 20408-09, 20460-61, 20420, 6-IV-1981, 2♀, 1♂, RMNH 20412-14, 18-IV-1981, all leg. P.E. Ouboter & L. Nanhoe. Bhurjung Khola - Chipli, 1970-2370 m: 3♀, 2♂, RMNH 20415-19, 21-IV-1981, leg. P.E. Ouboter & L. Nanhoe. Tang Ting forest, 2070 m: 3 juv., RMNH 20561-63, 28-IX-1978, leg. P.E. Ouboter & H. van Meeuwen; 2070 m: 3♂, RMNH 20421-23, 25-IV-1981; 2390 m: 1♀, RMNH 20424, 25-IV-1981, all leg. P.E. Ouboter & L. Nanhoe. 2 km S of Telbrung Danda, 2530 m: 2♀, 1♂, RMNH 20425-27, 29-IV-1981, leg. P.E. Ouboter & L. Nanhoe. 2 km S of Chamce, 1340 m: 1♀, RMNH 20428, 2-V-1981, leg. P.E. Ouboter & L. Nanhoe. Tal, 1640 m: 1♀, 1 juv., RMNH 20429-30, 3-V-1981, leg. P.E. Ouboter & L. Nanhoe. 1 km W of Bagarchap, 2080 m: 1♀, RMNH 20431, 4-V-1981, leg. P.E. Ouboter & L. Nanhoe. 3 km SE of Bradang, 2800 m: 2♀, 1♂, RMNH 20432-34, 5-V-1981, leg. P.E. Ouboter & L. Nanhoe.

Diagnosis. — A rather small scincid lizard, snout-vent length about 39 mm (Ouboter, 1986.). Transparent window in lower eyelid medium-sized. Ciliars not thickened. Frontal touching the first two supraoculars. Only the fifth supralabial situated under the eye. Ear round and very small, without distinct projecting lobules. Some pairs of enlarged nuchals. Only 21 to 29 scales around midbody. Dorsum bronze-brown, usually with some irregularly arranged dark brown to black spots. A distinct dark brown lateral band, sometimes bordered by a gold coloured dorso-lateral line. Ventral parts white to greenish white, yellow or greyish. In spring the chin, the lower flanks and the subcaudal region become orange.

Habitat. — The most abundant lizard in the forest zone. Not living in the dense forest itself, but in clearings or at the edge of the forest. Always in rather damp places, which are usually covered with mosses and dry leafs. Mostly not found above 3000 m, but at Ghorapani at 3200 m.

It is a heliotherm lizard, which is only active during sunshine. According to Annandale (1912a) this species lays its eggs between moss on tree-trunks.

Distribution. — See fig. 6. An Eastern Himalayan species. Range: central Nepal, Sikkim/Darjeeling, Assam, Chota Nagpur. Not found west of Jaljala Pass, in the drier Garhwal Himalayas. Here it is replaced by *S. ladacensis himalayana* (Ouboter, 1986). In the Annapurna area *S. sikimmensis* is not found north of Shyang in the Kali Gandaki Valley and in the Manang Valley, areas which probably are too dry. Between Bradang and Pisang some seemingly ideal habitats exist, which apparently were not reached by *S. sikimmensis,* maybe because of the dense forests between these villages (also see *Agama tuberculata*).

Remarks. — The specimens of the dry Marsyandi and Kali Gandaki Valleys and those of Ghorapani on average have more scales around their body (26-28) than usual (22-25), but Ouboter (1986) still considers them to be *S. sikimmensis*.

Sphenomorphus maculatus (Blyth, 1853)
(fig. 6)

Lissonota maculata Blyth, 1853: 653 (type loc. Assam).
Hinulia maculata – Theobald, 1868: 25; Stoliczka, 1870: 174; Stoliczka, 1872a: 123.
Lygosoma maculatum – Boulenger, 1887a: 242; Boulenger, 1890: 196; Hora, 1927: 4; Smith, 1935: 285.
Sphenomorphus maculatus – Swan & Leviton, 1962: 139.

Material examined. — Beni, 980 m: 1♂, RMNH 20470, 20-VII-1981, 1 ex., field no. RMNH 0615 (Nepal), 20-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Bhurungdi Khola, 1060 m: 1♀, 2♂, BMNH 1955.1.13.33-35, 5-V-1954, leg. K.H. Hyatt. Madi Khola (below Thak), 920 m: 1 juv., RMNH 20564, 26-IX-1978, leg. P.E. Ouboter & H. van Meeuwen; 2♂, RMNH 20465-66, 23-IV-1981, leg. L. Nanhoe & P.E. Ouboter. 3 km N of Namarjang, 1300 m: 2♂, RMNH 20467-68, 24-IV-1981, leg. L. Nanhoe & P.E. Ouboter. 4 km NW of Khudi, 820 m: 1♂, RMNH 20469, 30-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Diagnosis. — A medium-sized scincid lizard (snout-vent length about 62 mm). Thirty eight to 42 scales round the body. Limbs well developed. Rostral flat or concave; no nuchals; the fifth and sixth supralabial below the eye, separated from it by small scales; tympanum deeply sunk. Bronze or brown above with a vertebral row of dark brown spots. A dark brown lateral band

from the rostral through the eye, clearly visible up to the hindlimbs, fading away on the tail. Lower parts of flanks more or less speckled with white and dark brown. Ventral parts yellow or white except for the chin and gular region, which are white to grey. The yellow colour of the ventral parts is probably seasonal. Only some of the male specimens collected, showed this colour, which disappeared after conservation in alcohol. It is not known, whether this feature appears in both sexes or only in the males.

Habitat. — A species confined to a few, low altitude localities along rivers. They occurred at the edge of the forest, between the stones of the riverbed. Probably it is a species that is confined to riverine forest of *Alnus nepalensis,* a forest heavily disturbed by man. That is why only few, relic populations of *S. maculatus* are found. In Beni, where hardly any tree was left, the lizards obviously adapted themselves to living between the stones of the numerous stairs, which formed the path.

Distribution. — See fig. 6. An Indo-Chinese species. Range: central Nepal, Sikkim/Darjeeling, Assam and northern Bengal (Parasnath Hill), south-western Yunnan, Burma, Thailand, Cambodia, southern Vietnam, Andaman and Nicobar Islands. *S. maculatus* has not been mentioned for Nepal previously, though Hyatt had collected this species in 1954. Beni is the most western locality for this species. Considering the preference for a rather moist environment, it is not likely that it will be found much further west. It will probably occur in eastern Nepal as well. In the Annapurna area it is restricted to the area of low altitude south of the mountains.

Serpentes

Key to the families of the snakes of the Annapurna-Dhaulagiri area

1. Eyes vestigial, covered by shields; head not distinctly separated from the body; tail very short, ending in a tiny spine; body covered with uniform scales; teeth only in the upper jaw; 16-36 scales around the body .... Typhlopidae *(Rhamphotyphlops braminus)*
– Eyes exposed; head distinctly separated from the body; tail of medium size; medium row of ventral scales more or less distinctly enlarged, usually forming transverse shields; teeth in both jaws 2
2. Poison fangs on the maxillary bone in the front of the mouth. 3
– No poison fangs on the maxillary bone in the front of the mouth ... . Colubridae
3. Maxillary bone with teeth behind the fangs; pupil round; no pit between

the eyes and the nostrils; neck distinctly dilatable, scales usually smooth ..... Elapidae *(Ophiophagus hannah)*

– Maxillary bone very short, bearing fangs only; pupil vertical; a pit between the eyes and the nostrils; neck not distinctly dilatable, scales usually keeled ..... Crotalidae

Colubridae

Key to the species of colubrid snakes in the Annapurna-Dhaulagiri area.

1. Scales in 13 rows; ventrally dark brown ..... *Trachischium fuscum*
– Scales in more than 13 rows 2
2. Nineteen or fewer scale-rows 5
– Twenty-one or more scale-rows 3
3. Two anal shields ..... *Elaphe hodgsonii*
– One anal shield 4
4. More than 23 scale-rows ..... *Elaphe helena*
– Less than 23 scale-rows ..... *Boiga trigonata*
5. Nineteen scale-rows 8
– Less than 19 scale-rows 6
6. Nine or more supralabials 7
– Eight or fewer supralabials ..... *Ptyas mucosus*
7. One anterior temporal ..... *Sibynophis collaris*
– Two anterior temporals ..... *Lycodon aulicus*
8. One anal shield ..... *Elaphe radiata*
– Two anal shields 9
9. Two anterior temporals 11
– One anterior temporal 10
10. More than 160 ventrals ..... *Amphiesma platyceps*
– Less than 160 ventrals ..... *Amphiesma stolatum*
11. Scales on the anterior part of the body oblique ..... *Pseudoxenodon macrops*
– Scales on the anterior part of the body parallel 12
12. A yellow or orange cross-band in the neck; scales of the three middorsal rows narrower than the adjacent scales .... *Rhabdophis himalayanus*
– No light or dark cross-band in the neck; dorsal scales of equal size 13
13. More than 170 ventrals ..... *Amphiesma platyceps*
– Less than 170 ventrals ..... *Xenochrophis piscator*

Amphiesma platyceps (Blyth, 1854)
(fig. 7)

Tropidonotus platyceps Blyth, 1854: 297 (type loc. Assam and Darjeeling); Günther, 1860: 162; Günther, 1861: 217; Günther, 1864: 264; Theobald, 1876: 174; Boulenger, 1890: 343; Boulenger, 1893b: 248; Wall, 1907: 152; Wall, 1909a: 340.
Tropidonotus chrysargus (not of Boie) Günther, 1858b: 70; Günther, 1860: 162; Günther, 1861: 217; Wall, 1907: 156.
Herpetoreas sieboldii Günther, 1860: 156.
Zamenis himalayanus Steindachner, 1867: 513.
Tropidonotus firthi Wall, 1914: 166.
Rhabdophis firthi – Wall, 1923: 606.
Natrix platyceps – Shaw et al., 1939a: 118; Smith, 1943: 305; Smith, 1951: 728; Smith & Battersby, 1953: 703; Swan & Leviton, 1962: 114; Waltner, 1975c: 18.
Amphiesma sieboldii – Malnate, 1966: 1; Dierl & Gruber, 1979: 45.
Amphiesma platyceps – Malnate, 1966: 1; Fleming & Fleming, 1974: 430; Kramer, 1977: 729; Majupuria, 1981: 162.

Material examined. — Lumsum, 2200 m: 1♂, BMNH 1955.1.13.71, 3/4-X-1954, leg. K.H. Hyatt. Tatopani, 1550 m: 1♀, ZSM 146/1973, V-1973, leg. U. Gruber & D. Fuchs. Lete, 2450 m: 1♀, RMNH 20504, 20-V-1981, leg. L. Nanhoe & P.E. Ouboter. Kalopani, 2500 m: 1♀, ZSM 148/1973, 3-VI-1973, 1♂, ZSM 150/1973, 15-VI-1973, both leg. U. Gruber & D. Fuchs. Taglung, 3100 m: 2♂, BMNH 1955.1.13.69-70, 29-X-1954, leg. K.H. Hyatt. Taksang, 2880 m: 1 juv., ZSM 147/1973, 28-VI-1973, leg. U. Gruber & D. Fuchs. Tukche, 2500 m: 1♀, ZSM 144/1973, 23-VI-1973, leg. U. Gruber & D. Fuchs. Sikha, 2000 m: 1♀, ZSM 143/1973, 20-VII-1973, leg. U. Gruber & D. Fuchs. Birethanti, 1040 m: 1 ex., ZSM -, 1979, leg. U. Gruber. Kyumnu Khola (near Gandrung): 1 ex., ZSM 142/1973, 24-V-1973, leg. U. Gruber & D. Fuchs. Gandrung forest, 2360 m: 1♀, ZSM 145/1973, 16-V-1973, 1♂, ZSM 149/1973, 23-V-1973, both leg. U. Gruber & D. Fuchs. 2 km S of Landrung, 1650 m: 1♀, RMNH 20502, 7-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Naudanda, 1400 m: 1 ex., ZSM -, 1979, leg. U. Gruber. Tang Ting forest, 2190 m: 1♂, RMNH 20503, 25-IV-1981, leg. L. Nanhoe & P.E. Ouboter.
Literature references. — Mardi Khola, 1600 m: 1 ex., MHNG 1355.72, V-1964, 1 ex., MHNG 1355.73, 27-VI-1964, both leg. H. Schnurrenberger (Kramer, 1977).

Diagnosis. — A small to medium-sized snake; total length under 120 cm. One anterior temporal. Dorsal scales in 19 rows, more or less distinctly keeled, those of the outer rows often smooth; more than 170 ventrals. Two anal shields. Dorsally grey to bronze-brown. A dark brown stripe from the nasal through the eye to the last supralabial. Ventrally yellowish white.

Habitat. — This species is usually found at the edge of the forest. It is not associated with cultivated areas; one specimen (Tang Ting, RMNH 20503) was collected several kilometers inside dense oak forest. In Western Nepal it was found at an altitude of 3660 m (Smith & Battersby, 1953).

Distribution. — See fig. 7. A widely distributed Himalayan species. Range: Kashmir, Himachal Pradesh, Himalayan regions of Uttar Pradesh, Nepal, Sikkim, Assam. Swan & Leviton (1962) listed *A. platyceps (Natrix platyceps)* in table 1 as a Mediterranean species, so with a western distribution. Accor-

ding to both Smith (1943) and Kramer (1977) it does not range west of Kashmir, but east to Sikkim and Assam. So, it should be called a Himalayan species. The apparent absence of this species along the Marsyandi River and in the Manang Valley is very remarkable, although the habitat seems suitable. Until now only few collectors have visited this area. *A. platyceps* might be found here in the future.

Remarks. — The scale-numbers of the specimens collected by us, are within the range given by Kramer (1977). However, a female from Lete (RMNH 20504; V 207, C 99), according to Kramer's figure 3, would not be expected there, but at least five degrees further west. Apparently the variation within one population is greater than was supposed by Kramer (1977).

Amphiesma stolata (Linnaeus, 1758)
(fig. 7)

Coluber stolatus Linn., 1758: 219; Linn., 1766: 379 (type loc. Asia).
Tropidonotus stolatus – Günther, 1858b: 68; Günther, 1860: 162; Boulenger, 1890: 348; Sclater, 1891: 39; Boulenger, 1893b: 253; Wall, 1907: 156.
Natrix stolata – Smith, 1943: 303; Swan & Leviton, 1962: 114; Waltner, 1975c: 18.

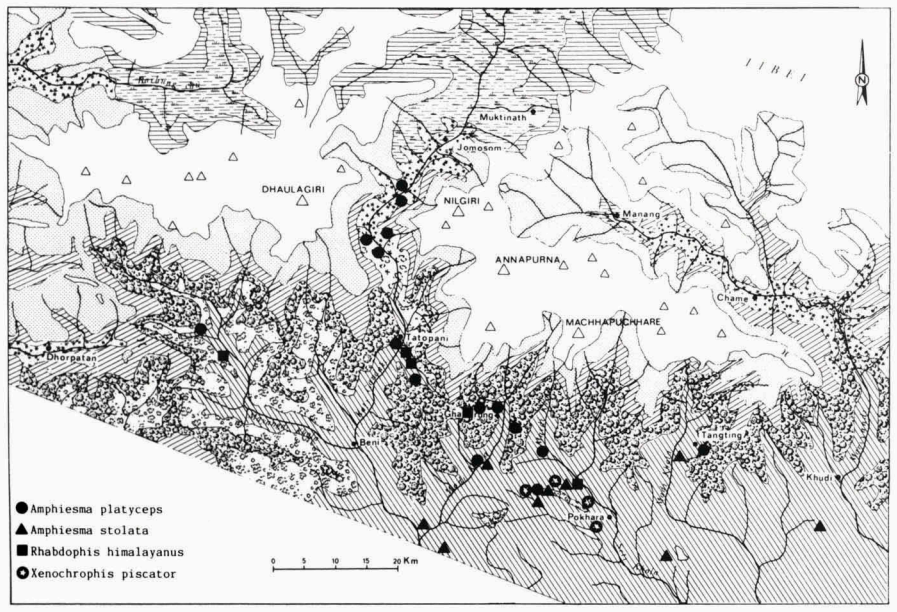

Fig. 7. The distribution of the natricine snakes. Legend see fig. 3.

Amphiesma stolata – Fleming & Fleming, 1974: 431; Majupuria, 1981: 162.
Amphiesma stolatum – Kramer, 1977: 734.

Material examined. — Kusma, 1060 m: 1 ex., BMNH 1955.1.13.72*, 11-VI-1954, leg. K.H. Hyatt. Bheda-bari-phedi, 1130 m: 1♂, RMNH 20506, 3-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Chandrakot, 1640 m: 1 ex., ZSM 152/1979, 26-II-1977, leg. D. Fuchs. Naudanda, 1550 m: 2 ex., ZSM 109/1973, 10-V-1973, leg. U. Gruber & D. Fuchs; 1 ex., ZSM -, 1979; 1350 m: 1 ex., ZSM -, 1979, both leg. U. Gruber. Suikhet, 1100 m: 1 ex., ZSM 108/1973, 9-V-1973, leg. U. Gruber & D. Fuchs. 3 km N of Namarjang, 1300 m: 1♀, RMNH 20505, 24-IV-1981, leg. L. Nanhoe & P.E. Ouboter. 5 km NE of Nalma (E of Lamjung), 1200 m: 1 juv., RMNH 21928, 8-X-1978, leg. P.E. Ouboter & H. van Meeuwen.

Literature references. — Suikhet, 1100 m: 20 ex., MHNG 1355.80, 82-100, 1962-1964, leg. H. Schnurrenberger (Kramer, 1977).

Field observation. — Begnos Tal, 900 m: 1 adult, S 79, 10-X-1978, by P.E. Ouboter & H. van Meeuwen.

Diagnosis. — A small to medium-sized snake; total length under 100 cm. Internasals much narrowed anteriorly; frontal constricted in the middle; one preocular; one anterior temporal. Dorsal scales in 19 rows, strongly keeled except the outer row; less than 160 ventrals. Two anal shields. Dorsally grey to greenish-grey with two very distinct dorso-lateral yellowish white stripes, which fade away on the anterior part of the body. Regularly arranged black spots between the stripes and the flanks, sometimes forming cross-bands. The black spots or cross-bands are most distinct on the anterior part of the body. Ventrally yellowish white.

Habitat. — Common in and near cultivated areas, especially rice-fields and ponds. Its main food probably exists of the sawah-dwelling frogs of the subgenus *Dicroglossus*: *Rana cyanophlyctis, Rana limnocharis* and *Rana tigerina*.

Distribution. — See fig. 7. A Panoriental species. Range: Western Himalayas, Nepal, Sikkim/Darjeeling, plains of India, Sri Lanka, Andaman Islands, Khasi Hills, Burma, southern China, Indo-China north of 14°N. In the Annapurna-Dhaulagiri region restricted to the low altitude area south of the main Himalayan chain.

Rhabdophis himalayanus (Günther, 1864)
(fig. 7)

Tropidonotus himalayanus Günther, 1864: 265 (type loc. Sikkim and Nepal); Theobald, 1876: 178; Boulenger, 1890: 347; Boulenger, 1893b: 251; Wall, 1909a: 341; Wall, 1909b: 614.
Rhabdophis himalayanus – Wall, 1923: 605; Kramer, 1977: 746.
Natrix himalayana – Shaw et al., 1939a: 120; Smith, 1943: 300; Swan & Leviton, 1962: 113; Waltner, 1975c: 17.
Amphiesma himalayana – Fleming & Fleming, 1974: 430; Majupuria, 1981: 162.

Material examined. — Siwang, 1950 m: 1 adult, field no. RMNH 0613 (Nepal), 17-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 3 km S of Tatopani, 1230 m: 1 juv., RMNH 20508, 22-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 1 km S of Ghara, 1820 m: 1♂, RMNH 20507, 24-V-1981, leg. L. Nanhoe & P.E. Ouboter. Gandrung forest, 2350 m: 1 ex., ZSM 117/1973, 15-V-1973, leg. U. Gruber & D. Fuchs.

Literature reference. — Suikhet, 1100 m: 1 ex., MHNG 1374.99, 1962-1964, leg. H. Schnurrenberger (Kramer, 1977).

Diagnosis. — A medium-sized snake; total length usually under 150 cm. Two anterior temporals. The three median rows of scales on the nuchal region are narrower than the other dorsal scales. Dorsal scales in 19 rows, strongly keeled, those of the outer rows feebly keeled. Two anal shields. Dorsally olive-green to dark brown with two dorso-lateral rows of widely separated small orange spots (yellow in preserved specimens), which are more numerous anteriorly. A bright yellow or orange collar in the neck, sometimes caudally edged with black. Labials yellowish white edged with black. Ventrally yellowish-white, becoming darker caudally.

Habitat. — Usually found on rocky slopes near cultivated land and near a small stream.

Distributon. — See fig. 7. An Eastern Himalayan species. Range: Central Nepal, Sikkim/Darjeeling, Assam, Upper Burma. It is likely that the Jaljala Pass forms the western limit of its distribution, since no specimens are found west of this pass as yet.

Remarks. — Two species of this genus, i.e. *Rhabdophis tigrinus* and *subminiatus* are reported to be rather poisonous (resp. Mittleman & Goris, 1974; Minton & Mebs, 1978, and Romer, 1979). The venomousness of *R. himalayanus* is unknown.

Xenochrophis piscator (Schneider, 1799)
(fig. 7)

Hydrus piscator Schneider, 1799: 247 (type loc. East Indies; based on Russell's "Neeli Koea", Russell, 1796: 38, pl. 33).

Tropidonotus quincunciatus var. Günther, 1858b: 63, 66; Günther, 1860: 162; Günther, 1861: 217; Günther, 1864: 260.

Tropidonotus piscator – Wall, 1907: 857.

Tropidonotus sanctijohannis Boulenger, 1890: 350; Boulenger, 1893b: 230.

Natrix piscator – Shaw et al., 1939a: 117; Smith, 1943: 293; Swan & Leviton, 1962: 114; Waltner, 1975c: 18.

Xenochrophis piscator – Fleming & Fleming, 1974: 430; Kramer, 1977: 750; Majupuria, 1981: 163.

Material examined. — Suikhet - Pokhara, 960-1100 m: 1 ex., ZSM 128/1973, 9-V-1973, leg. U. Gruber & D. Fuchs.

Literature references. — Naudanda, 1500 m: 4 ex., MCZ 58832-35 (Kramer, 1977); MHNG 1376.80,81,86-91, 89-93(?), 1962-1964, leg. H. Schnurrenberger (Kramer, 1977). Suikhet, 1100 m: MHNG 1376.88-100(?), 1377.1-24, 1385.55, all leg. H. Schnurrenberger (Kramer, 1977). Phewa Tal, 960 m: 3 ex., MCZ 58235-37 (Swan & Leviton, 1962).

Diagnosis. — A medium-sized snake; total length under 150 cm. Nostrils directed slightly upwards. Frontal constricted in the middle; internasals much narrowed anteriorly; one preocular; two anterior temporals. Dorsal scales in 19 rows, more or less distinctly keeled, except the one or two outer rows, which are smooth. Dorsally brown, some scales on the flanks with black. Ventrally white.

Habitat. — This species is common in rice-fields at low altitudes and is always found near water.

Distribution. — See fig. 7. A Panoriental species. Range: northern and central India, Nepal, Sikkim/Darjeeling, Upper Burma, Yunnan, Upper Laos. In Nepal it seems to be absent from the steep mountainous area just south of the high Himalayas. Most Nepalese specimens were collected in the Terai and the large valleys of Kathmandu and Pokhara.

Elaphe helena (Daudin, 1803)
(fig. 8)

Coluber helena Daudin, 1803a: 277 (based on Russell's plate: Russell, 1796: 37, pl. 32) (type loc. Vizagapatam, Andhra Pradesh); Boulenger, 1890: 331; Boulenger, 1894: 36.
Elaphe helena – Shaw et al., 1939b: 78; Smith, 1943: 149; Swan & Leviton, 1962: 140; Fleming & Fleming, 1974: 428; Kramer, 1977: 738, Majupuria, 1981: 160.

Material examined. — Pokhara, 914 m: 1 juv., BMNH 1955.1.13.77, 27-VIII-1954, leg. K.H. Hyatt.

Literature reference. — Naudanda, 1500 m: 8 ex., MHNG 1377.92-99, 1963-1964, leg. H. Schnurrenberger & B. Thaba (Kramer, 1977).

Diagnosis. — A medium-sized snake with a maximum total length of about 150 cm. More than seven supralabials. Dorsal scales in more than 23 rows, scales distinctly keeled on the posterior part of the body and tail. One anal shield. Dorsally light or dark brown with two longitudinal black stripes on the neck, often converging posteriorly to a V-shape. Laterally two distinct dark stripes. Ventrally greyish-white.

Habitat. — All localities are in areas with much cultivated land. No exact habitat data are available.

Distribution. — See fig. 8. An Indian species. Range: Pakistan, India, Nepal, Assam, Sri Lanka.

Elaphe hodgsonii (Günther, 1860)
(fig. 8)

Spilotes hodgsonii Günther, 1860: 156 (type loc. Nepal); Günther, 1861: 218.
Compsosoma hodgsonii – Günther, 1864: 246; Theobald, 1876: 166.
Coluber hodgsonii – Boulenger, 1890: 332; Sclater, 1891: 31; Boulenger, 1894: 35; Wall, 1923: 622.
Elaphe hodgsonii – Shaw et al., 1939b: 75; Smith, 1943: 152; Smith & Battersby, 1953: 704; Swan & Leviton, 1962: 113; Fleming & Fleming, 1974: 429; Kramer, 1977: 739; Majupuria, 1981: 160.

Material examined. — Siklis, 2740 m: 1♀, BMNH 1955.1.13.78, 21-VIII-1954, leg. K.H. Hyatt.

Literature reference. — Tarakot, 3200 m: 1♀, 1952, leg. O. Polunin, a.o. (Smith & Battersby, 1953).

Diagnosis. — A snake with a total length of about 150 cm. Interparietal scales in front in contact with each other. Dorsal scales in 21-25 rows, scales smooth or feebly keeled. Two anal shields. Dorsally olive-brown; many of the scales edged with black. Ventrally yellowish-white.

Habitat. — This species is known from very different habitats. Siklis is in an area of wet oak forest, Tarakot in an area of dry coniferous forest. In the

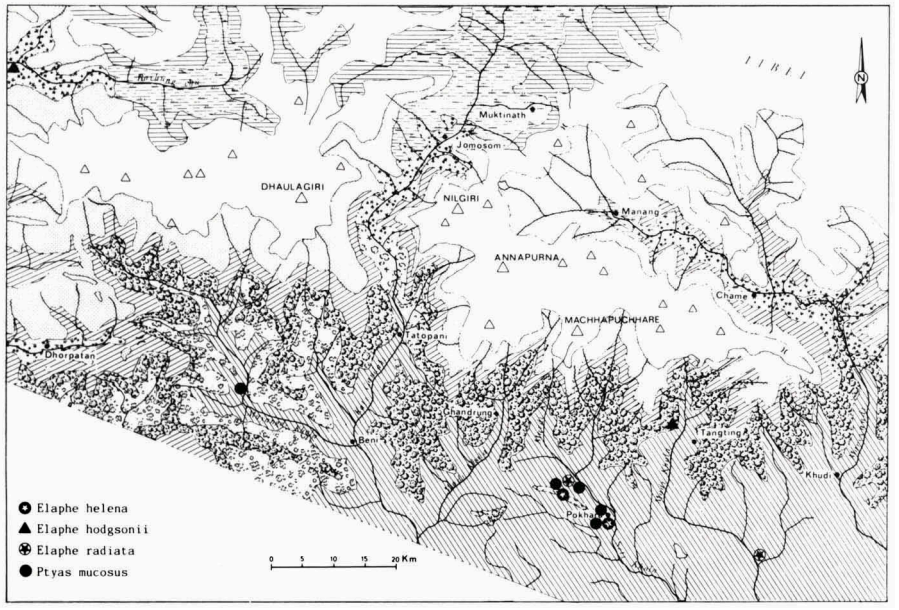

Fig. 8. The distribution of some colubrine snakes (*Elaphe* and *Ptyas*). Legend see fig. 3.

Western Himalayas it has been collected at an altitude of 1000 m as well as 5000 m (Kramer, 1977).

Distribution. — See fig. 8. According to Swan & Leviton (1962, tab. 1) a Western Himalayan species occurring in Ladakh and Kashmir. Smith (1943) mentioned this species for Sikkim and Assam (Garo Hills) as well; thus we consider *E. hodgsonii* a Himalayan species. Considering its opportunistic habitat selection it could occur on all sides of the Annapurna and Dhaulagiri, but apparently it is quite rare.

Elaphe radiata (Schlegel, 1837)
(fig. 8)

Coluber radiatus Schlegel, 1837: 135 (type loc. Java); Boulenger, 1890: 333; Boulenger, 1894: 61; Wall, 1910: 825.
Coluber quadrifasciatus Cantor, 1839: 51.
Elaphe radiata – Shaw et al., 1939b: 73; Smith, 1943: 146; Leviton, Myers & Swan, 1956: 12; Swan & Leviton, 1962: 113; Kramer, 1977: 741.

Material examined. — Chisankhu (confluence of Madi and Midam Khola), 600 m: 1 ex., ZSM -, 1979, leg. U. Gruber.
Literature reference. — Suikhet, 1100 m: 6 ex., MHNG 1370.50-54, 56, 1962-1964, H. Schnurrenberger (Kramer, 1977).

Diagnosis. — A rather large snake; maximum size about 210 cm in total length. Nine supralabials. Dorsal scales in 19 rows, distinctly keeled. One anal shield. Dorsally greyish to yellowish brown. In life sometimes with a red or green tinge. Two broad black stripes on the anterior half or two third of the body, which start a short distance behind the neck. A second, much narrower pair of black stripes, is present on the flanks, these are usually broken into a series of elongated spots on the anterior part of the body.

Habitat. — No data available. In Nepal only reported from low altitudes.

Distribution. — See fig. 8. According to Swan & Leviton (1962, tab. 1) it is a Panoriental species. Since its distribution in India is limited to the eastern part and since it has a wide distribution in Indo-China, we consider it to be an Indo-Chinese species. Range: From Orissa (E. India) and central Nepal to southern China and through the whole of the Indo-Chinese subregion to the Malay Peninsula. Also Sumatra, Java and Borneo. Suikhet (Annapurna region) is the most western locality reported so far.

Ptyas mucosus (Linneaus, 1758)
(fig. 8)

Coluber mucosus Linn., 1758: 226 (type loc. India).
Coluber blumenbachii Merrem, 1820: 119.
Coluber dhumna Cantor, 1839: 52.
Coryphodon blumenbachii – Günther, 1858b: 111; Günther, 1860: 163; Günther, 1861: 218.
Ptyas mucosus – Günther, 1864: 249; Shaw et al., 1939b: 68; Smith, 1943: 159; Leviton, Myers & Swan, 1956: 12; Swan & Leviton, 1962: 115; Fleming & Fleming, 1974: 432; Kramer, 1977: 745; Majupuria, 1981: 164.

Material examined. — Pokhara, 915 m: 1 ex., BMNH 1955.1.13.76*, 4-VIII-1954, leg. K.H. Hyatt; 800 m: 1 ex., ZSM 132/1973, 24-VII-1973, leg. U. Gruber & D. Fuchs; 960 m: 1♀, RMNH 20510, 3-VI-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Suikhet, 1100 m: 12 ex., MHNG 1375.9, 10, 12, 13, 15, 20-23, 29-31, 1962-1964, leg. H. Schnurrenberger (Kramer, 1977). Hyengja, 1000 m: 4 ex., MHNG 1374.69, 1375.14, 24, 26, 1962-1964, leg. H. Schnurrenberger (Kramer, 1977).

Field observations. — Takum (Mayangdi Khola), 1750 m: 1 adult, S 64, 8-VII-1981.

Diagnosis. — A large snake with a maximum size of more than 200 cm in total length. Eight or less supralabials. Dorsal scales in less than 19 rows; scales smooth or those of the median rows more or less distinctly keeled. More than 97 subcaudals. Dorsally brown to olive-brown; dorsal scales on the posterior part of the body up to the tail edged with black. Labials edged with black as well. Ventrally white.

Habitat. — This species is common in cultivated areas at low altitudes. Probably living right up to the lower edge of the forest at about 1800 m. Only a small number of specimens was collected in the area discussed, because they are extremely difficult to catch. Many large snakes, probably belonging to this species, were seen by us in the Mayangdi Khola Valley. Local people often see similar snakes and call them cobras. Since *Naja naja* is not known from the area and *Ophiophagus hannah* is extremely rare, we assume that the local name refers to this species.

Distribution. — See fig. 8. A Panoriental species. Range: Baluchistan, Afghanistan, Turkistan, Chitral, Kashmir, northern India, Nepal, Sri Lanka, Andaman Islands, the whole of Indo-China, southern China. In the Annapurna-Dhaulagiri region it is restricted to the cultivated area south of the main Himalayan range.

Boiga trigonata (Schneider, 1802)
(fig. 9)

Coluber trigonatus Schneider, in Bechstein, 1802: 256 (type loc. Vizagapatam, Andhra Pradesh).

Dipsas trigonata – Blyth, 1955: 294; Boulenger, 1890: 358.
Dipsadomorphus trigonatus – Boulenger, 1896: 62; Shaw & Shebbeare, 1930: 55; Shaw et al., 1940: 64.
Boiga trigonata – Smith, 1943: 349; Swan & Leviton, 1962: 113; Fleming & Fleming, 1974: 428; Kramer, 1977: 736; Majupuria, 1981: 159.

Literature reference. — Hyengja, 1100 m: 5 ex., MHNG 1356. 82, 83, 85-87, 1962-1964, leg. H. Schnurrenberger (Kramer, 1977).

Diagnosis. — A small to medium-sized snake; total length usually under 110 cm. Head very distinct from the neck. Eye large with a vertical pupil. Maxillary teeth followed by two or three enlarged, grooved fangs. One preocular. Dorsal scales usually in 21 rows, scales smooth, more or less oblique, with apical pits; vertebral scales feebly enlarged. One anal shield. Dorsally yellow to greyish brown with a pattern of grey, black-edged zig-zag markings. A grey, black-edged reversed Y-shaped mark on the top of the head. Ventrally white or grey.

Habitat. — This species probably occurs in cultivated areas. Fleming & Fleming (1974) mentioned five specimens from the Terai region, caught near houses.

Distribution. — See fig. 9. An Indian species. Range: the whole of the

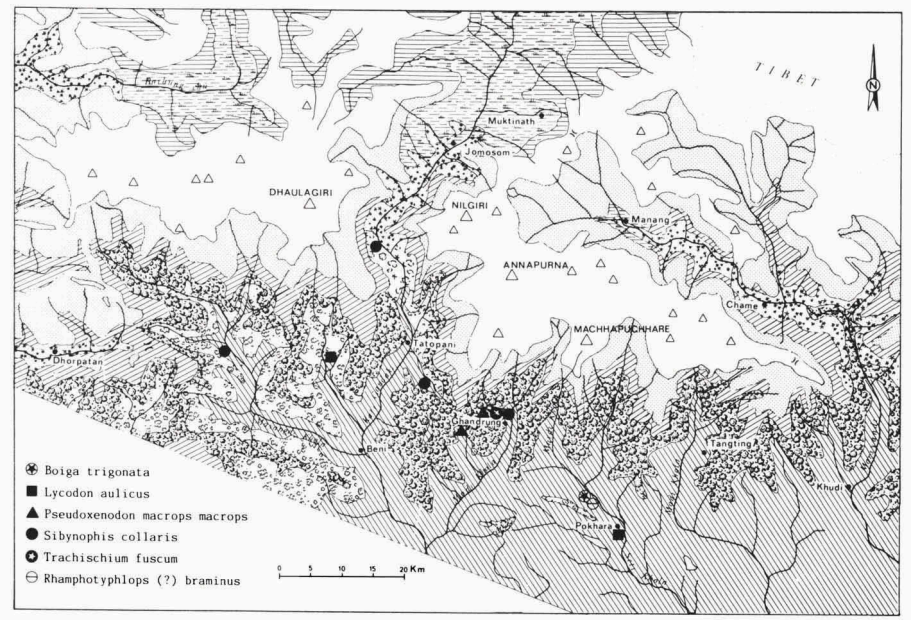

Fig. 9. The distribution of some colubrids and a typhlopid snake. Legend see fig. 3.

Peninsula of India, in the north from the Western Himalayas (N. Pakistan, Uttar Pradesh) to the Eastern Himalayas (Sikkim). In Nepal probably limited to lower altitudes south of the main Himalayan chain.

Lycodon aulicus (Linnaeus, 1758)
(fig. 9)

Coluber aulicus Linn., 1754: 29; Linn., 1758: 220 (type loc. "America").
Lycodon aulicus – Günther, 1860: 164; Günther, 1861: 219; Günther, 1864: 316; Boulenger, 1890: 294; Sclater, 1891: 14; Wall, 1907: 152; Smith, 1943: 263; Swan & Leviton, 1962: 113; Fleming & Fleming, 1974: 429; Kramer, 1977: 742; Majupuria, 1981: 161.

Material examined. — Jhin (14,5 km NW of Beni), 2130 m: 1 juv., BMNH 1955.1.13.74, 23-VII-1954, leg. K.H. Hyatt. Pokhara, 914 m: 1 juv., BMNH 1955.1.13.75, VIII-1954, leg. K.H. Hyatt.

Diagnosis. — A rather small snake; total length usually under 90 cm. Head flattened. Nine supralabials; two anterior temporals. Dorsal scales in 17 rows, scales smooth. Two anal shields. Less than 95 subcaudal shields. Dorsally brown or greyish brown with 12 to 19 cross-bars, which expand laterally enclosing triangular patches; these bars may be white or heavily speckled with brown. Labials and ventral parts white.

Habitat. — According to R.L. Shrestha (pers. comm.), who has collected many specimens in the Kathmandu Valley, it is very common around and inside houses, where it feeds on mice.

Distribution. — See fig. 9. An Indian species. Range: Pakistan, the whole of India, Sri Lanka, Maldives, Nepal, Sikkim/Darjeeling, Assam, Burma north of lat. 17°. In the Annapurna-Dhaulagiri area it is limited to the cultivated zone south of the main Himalayan chain.

Pseudoxenodon macrops macrops (Blyth, 1854)
(fig. 9)

Tropidonotus macrops Blyth, 1854: 296 (type loc. Darjeeling).
Tropidonotus angusticeps Blyth (in part), 1854: 295.
Tropidonotus sikkimensis Anderson, 1871a: 17.
Pseudoxenodon macrops – Boulenger, 1890: 340; Boulenger, 1913: 338; Smith, 1943: 311; Swan & Leviton, 1962: 115; Fleming & Fleming, 1974: 432; Kramer, 1977: 744; Majupuria, 1981: 164.
Pseudoxenodon angusticeps – Wall, 1923: 608; Shaw et al., 1939a: 151.

Material examined. — Gandrung forest, 2360 m: 1 ex., ZSM 131/1979, 12-V-1973, leg. U. Gruber & D. Fuchs.

Literature reference. — Ulleri, 2000 m: 1♂, BMNH 1955.1.13.73, 19-V-1954, leg. K.H. Hyatt (Kramer, 1977).

Diagnosis. — A medium-sized snake with a total length of about 140 cm. Nostrils large, between the two nasals. Loreal large, a little longer than high; one preocular, not touching the frontal; three postoculars; eight supralabials, the seventh highest; two anterior temporals. Dorsal scales in 19 rows, scales feebly or strongly keeled; scales on the anterior part of the body disposed obliquely, without apical pits. Two anal shields. Dorsally brown, olive or grey with or without a vertebral series of yellow to orange dark edged spots and a dorso-lateral series of black spots. A more or less distinct chevron-shaped mark sometimes present on the nape. Ventrally yellow, usually with black or brown spots.

Habitat. — Both specimens were found in an area dominated by wet oak forests. No exact habitat data are available.

Distribution. — See fig. 9. An Indo-Chinese species. Range: Nepal, Sikkim/Darjeeling, Assam, the whole of Burma as far north as lat. 28° and south to Peninsular Thailand, central and eastern Thailand, Laos and Vietnam north of lat. 16°. Probably not ranging further west than Jaljala Pass (Dhaulagiri area).

Remarks. — The subspecies *Pseudoxenodon macrops sinensis* occurs in Southern China. According to Smith (1943) it differs from the typical form in having fewer ventrals (138-162), fewer subcaudals (57-68) and in having usually only seven supralabials (in *P. macrops macrops* resp. 151-180, 55-80 and eight).

Sibynophis collaris (Gray, 1853)
(fig. 9)

Psammophis collaris Gray, 1853: 390 (type loc. Khasi Hills).
Polyodontophis collaris – Boulenger, 1890: 302; Wall, 1909a: 340.
Sibynophis collaris – Shaw et al., 1939a: 115; Smith, 1943: 277; Swan & Leviton, 1962: 115; Fleming & Fleming, 1974: 433; Kramer, 1977: 747; Majupuria, 1981: 165.

Material examined. — Macchim, 2020 m: 1♂, RMNH 20511, 8-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Kalopani, 2500 m: 1 ex., ZSM 151/1973, 15-VI-1973, leg. U. Gruber & D. Fuchs. Sikha, 2000 m: 1 ex., ZSM 138/1973, 20-VII-1973, leg. U. Gruber & D. Fuchs.

Field observation. — W bank of Modi Khola, 1815 m: 1 adult, S 8, 14-IV-1981.

Diagnosis. — A rather small snake; total length usually under 100 cm.

Teeth numerous and closely set; more than 30 in each maxilla. Nine or more supralabials; one anterior temporal. Dorsal scales in less than 19 rows. More than 95 subcaudals. Dorsally brown with a dark band in the neck, bordered with white behind. Dark brown spots on top of the head. Labials and ventral surface white.

Habitat. — The two specimens observed by us, were both found on the border of cultivated and rocky land, in the vegetation zone of oak forests. The locality Kalopani, however, is in coniferous forests, as is most of its range in the Western Himalayas (see below).

Distribution. — See fig. 9. Range: Himalayas and mountainous areas of Indo-China: Himachal Pradesh, Nepal, Sikkim/Darjeeling, Assam, Burma, Western Yunnan, hilly country of Thailand, the Malay Peninsula, Laos and Vietnam. One of the few Indo-Chinese species that occurs west of Jaljala Pass in the Garhwal Himalayas.

Trachischium fuscum (Blyth, 1854)
(fig. 9)

Calamaria fusca Blyth, 1854: 288 (type loc. Darjeeling).
Trachischium rugosum Günther, 1858b: 30.
Trachischium fuscum – Günther, 1860: 161; Günther, 1861: 215; Boulenger, 1890: 285; Smith, 1943: 322; Swan & Leviton, 1962: 115; Kramer, 1977: 748; Majupuria, 1981: 166.
Ablabes fuscus – Günther, 1864: 225.
Ablabes gilgiticus Annandale, 1905: 210.

Material examined. — Kyumnu Khola, 1900 m: 6 ex., ZSM 141/1973, 29-V-1973, leg. U. Gruber & D. Fuchs.

Diagnosis. — A small snake with a maximum total length of 70 cm. A single prefrontal; one postocular; one long anterior temporal. Dorsal scales in 13 rows, scales smooth except for those on the sides of the posterior part of the body and the base of the tail in males, which are keeled. In females these scales are only feebly keeled or smooth. Dorsally dark brown or black with or without indistinct light longitudinal streaks.

Habitat. — Kyumnu Khola is in the area of wet oak forests. No exact habitat data are available.

Distribution. — See fig. 9. Range: The Himalayas from Kashmir to Assam.

Typhlopidae

Rhamphotyphlops (?) **braminus** (Daudin, 1803)
(fig. 9)

Eryx braminus Daudin, 1803b: 279 (based on Russell, 1796: 48) (type loc. Vizagapatam, Andhra Pradesh).
Typhlops braminus – Cuvier, 1829: 73; Boulenger, 1890: 236; Smith, 1943: 46; Swan & Leviton, 1962: 142; Fleming & Fleming, 1974, 435; Kramer, 1977: 758; Majupuria, 1981: 173.
Typhlina (?) *bramina* – McDowell, 1974: 21; Hahn, 1980: 39.
Rhamphotyphlops braminus – Bosch, 1985: 6.

Material examined. — Hyengja, 900 m: 1 ex., ZSM 103/1973, 1973, leg. U. Gruber & D. Fuchs.

Diagnosis. — A worm-like snake; total length under 20 cm. Snout rounded, strongly projecting. Eyes small but distinct in the ocular shield or at its junction with the supraocular. Teeth only in the upper jaw. Scales in 16 to 36 rows around the body; tail very short. Dorsally brown or black. Ventrally light brown.

Habitat. — Quite common in cultivated areas in the Kathmandu Valley (Fleming & Fleming, 1974). No exact habitat data available.

Distribution. — See fig. 9. A species with a very wide distribution. Range: Africa (Zanzibar, South Africa), Arabia, Iran, whole of India, Sri Lanka, the Andaman and Nicobar Islands, Nepal, Indo-China, Indonesia, Philippines, Southern China, Hainan, Mexico.

Remarks. — There are some nomenclatorial problems about this species. Because of the absence of male specimens, McDowell (1974) could not make certain whether this species should be placed in the genus *Typhlops* or *Typhlina,* since the difference between these genera is based on differences in the hemipenis. He observed, however, many similarities between *braminus* and certain *Typhlina* species, on the basis of which he assumed that *braminus* actually belonged to this genus. Melville (1982) initiated the conservation of the generic name *Rhamphotyphlops* and the suppression of *Typhlina* on the basis of priority. If McDowell (1974) was right when tentatively placing *braminus* in the genus *Typhlina,* its correct name now is *Rhamphotyphlops braminus.*

Crotalidae

Key to the species of crotalid snakes in the Annapurna-Dhaulagiri area.

1. Parietal and frontal area of the head with large scales ..... *Agkistrodon himalayanus*
– Parietal and frontal area of the head with small scales 2
2. Head and body grass-green to blue-green, at most some scales black; ventral surface immaculate; first supralabial and nasal grown together .. *Trimeresurus albolabris*
– Head and back brown with dark brown spots or markings; ventral surface spotted with brown; first supralabial completely separated from the nasal ..... *Ovophis monticola*

Agkistrodon himalayanus (Günther, 1864)
(fig. 10)

Halys himalayanus Günther, 1864: 393 (type loc. Garhwal, West Himalayas); Stoliczka, 1870: 226; Anderson, 1872: 401; Blanford, 1878: 24.
Ancistrodon himalayanus – Boulenger, 1890: 424; Boulenger, 1896: 526; Gleadow, 1899: 577; Wall, 1899: 411; Wall, 1911: 142; Wall, 1928: 38; Smith, 1943: 495; Smith & Battersby, 1953: 704.
Agkistrodon himalayanus – Swan & Leviton, 1962: 116; Kramer, 1977: 753; Dierl & Gruber, 1979: 45; Majupuria, 1981: 173.

Material examined. — Dhorpatan, 3000 m: 1♀, RMNH 20513, 13-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Gurja Ghat, 3050 m: 1♂, RMNH 20514, 14-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Gurjakhani, 2590 m: 1♀, 8♂, 2 juv., BMNH 1955.1.13.83-93, VII-1954, leg. K.H. Hyatt. Ghasa, 2130 m: 1♂, BMNH 1955.1.13.80, 1-X-1954, leg. K.H. Hyatt. Lete, 2440 m: 1♀, BMNH 1955.1.13.79, 6-IX-1954, leg. K.H. Hyatt. Kalopani, 2500 m: 7 ex., ZSM 154/1973, 155/1973, 156/1973, 8-VI-1973, all leg. U. Gruber & D. Fuchs; 1 ex., ZSM -, 1979, leg. U. Gruber. Tukche, 2700 m: 1 ex., ZSM 157/1973, 24-VI-1973, leg. U. Gruber & D. Fuchs. Tal, 1640 m: 1♂, RMNH 20512, 3-V-1981, leg. L. Nanhoe & P.E. Ouboter.
Literature references. — Dhorpatan, 2400 m (?): 2 ex., MHNG 1329.6-7, IX-1963, leg. L, Naef; 1 ex., MHNG 1329.8, X-1963, leg. R. Weismüller (Kramer, 1977). Tukche, 2400 m: 1 ex., MHNG 1329.5, X-1962, leg. V. Janicke (Kramer, 1977).

Diagnosis. — A small to medium-sized snake; total length usually under 80 cm. Canthus rostralis sharp; upper preocular reaching the top of the head; second supralabial small; a deep pit between the preoculars and the loreal; internasals wider than long, much smaller than the prefrontals; three large temporals. Dorsal scales strongly keeled, in 21 rows. Dorsally light brown or bronze-brown with irregular dark brown spots. A dark brown band behind the eye up to the neck. Ventrally black and white dotted.

Habitat. — This species is associated with rather dry coniferous forests (*Picea, Pinus*) and is not recorded from the wet oak forests. All three specimens collected by us were found in rather open places with small bushes and stones. It is a nocturnal species, during daytime hidden under stones, logs or small bushes. Its main prey seems to exists of coldblooded animals like lizards (Wall, 1911) and frogs (one *Rana* spec. was found in the stomach of a specimen from Dhorpatan, RMNH 20513).

Distribution. — See fig. 10. Probably a Western Himalayan species. Range: northern Pakistan, Kashmir, western and central Nepal, Sikkim, Khasi Hills (?). Since this species is very abundant in the Western Himalayas (Boulenger, 1890; Wall, 1899) and only known from two records in the Eastern Himalayas and the Khasi Hills, it is possible that these last records either are based on mistaken localities (see Smith, 1943) or represent relic populations in some of the dry valleys that exist here because of thermal winds. The record of Tal is probably the most eastern one in the really dry area. It is the only record for the Marsyandi Valley, so it is probably rare here as well. From the Kali Gandaki Valley many records exist.

No significant differences in scale numbers could be found in specimens from different localities. Probably isolation of some of these populations occurred rather recently.

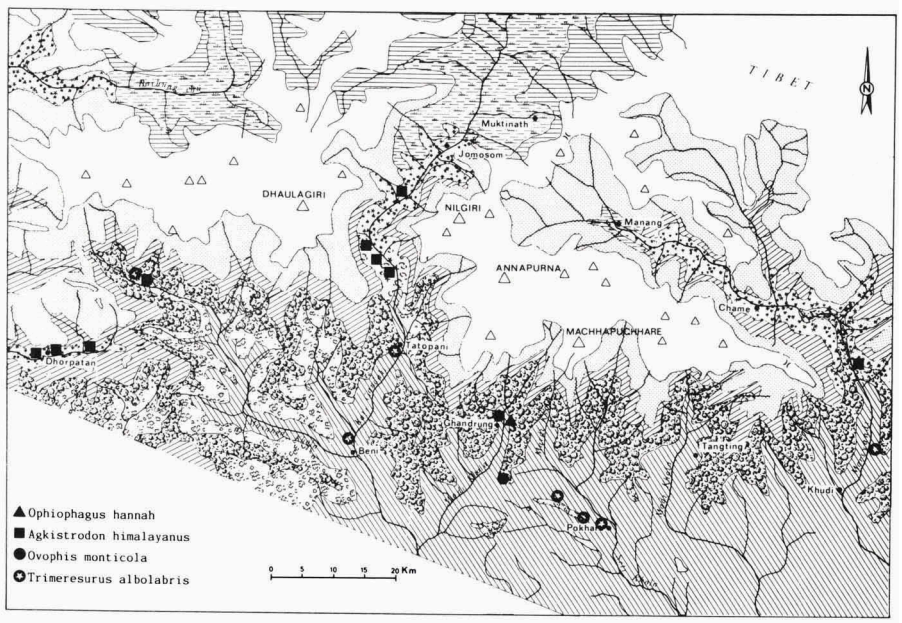

Fig. 10. The distribution of the elapid and crotalid snakes. Legend see fig. 3.

A likely hypothesis to explain the distribution and the relic populations is to postulate drier conditions on the southern side of the Himalayas during the last glacial period, so that this species could extend its range to the east. When the climate on the southern side became wetter again, only relic populations survived in the dry Himalayan valleys.

Ovophis monticola (Günther, 1864)
(fig. 10)

Parias maculata (not of Gray, 1842) Gray, 1853: 392 (type loc. Sikkim); Günther, 1860: 164; Günther, 1861: 220.
Trimeresurus monticola Günther, 1864: 388 (type loc. Nepal); Smith, 1943: 508; Swan & Leviton, 1962: 116; Fleming & Fleming, 1974: 435; Waltner, 1975d: 15; Kramer, 1977: 757; Majupuria, 1981: 171.
Lachesis monticola – Boulenger, 1896: 548; Wall, 1907: 157; Wall, 1909a: 356.
Ovophis monticola – Hoge & Romano Hoge, 1978: 247.

Material examined. — Kyumnu Khola, 1900 m: 1 ex., ZSM 160/1973, 24-V-1973, leg. U. Gruber & D. Fuchs. Lumle, 1550 m: 1 ex., ZSM -, 1979, leg. U. Gruber.

Diagnosis. — A medium-sized snake with a total length up to 125 cm. Seven to ten supralabials, the first completely separated from the nasal; internasals large, usually separated by one or two scales; subocular usually broken up into small scales; supraoculars large, not much longer than wide; upper headscales small, unequal. Dorsal scales in 21 to 25 rows, usually distinctly keeled; 137 to 176 ventrals. Dorsally light or dark brown with large irregularly placed dark brown spots on the back and smaller ones on the sides. Head dark brown above; usually a light streak from the eye to the angle of the jaw. Ventrally white spotted with brown.

Habitat. — According to Fleming & Fleming (1974) this species is found in yards as well as in pine forests in the Kathmandu Valley. A specimen found by them in eastern Nepal was resting in dense forest under a covering of wet moss and leaves. The specimen of Kyumnu Khola (ZSM 160/1973) was collected in an area of wet oak forest. *O. monticola* apparently is rather opportunistic with regard to its habitat selection.

Distribution. — See fig. 10. Range: central and eastern Nepal, the Eastern Himalayas, Burma, southeastern Tibet, Yunnan, Thailand. An Indo-Chinese species of which only two records are known for the Annapurna area, where it probably reaches the western limit of its range. It is much more abundant in the Kathmandu Valley (Kramer, 1977; R.L. Shresta, pers. comm.).

Trimeresurus albolabris Gray, 1842
(fig. 10)

Trimeresurus albolabris Gray, 1842: 48 (type loc. China); Smith, 1943: 523; Smith, 1951: 728; Swan & Leviton, 1962: 116; Fleming & Fleming, 1974: 435; Kramer, 1977: 755; Majupuria, 1981: 171.

Material examined. — Gurjakhani, 3050 m: 1 juv., BMNH 1955.1.13.81, 1-VII-1954, leg. K.H. Hyatt. 2 km N of Beni, 990 m: 1♀, RMNH 20516, 20-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Tatopani, 1200 m: 1♀, RMNH 20515, 23-V-1981, leg. L. Nanhoe & P.E. Ouboter. Pokhara, 1060 m: 1♀, BMNH 1955.1.13.82, 10-VIII-1954, leg. K.H. Hyatt.

Literature references. — Suikhet, 1100 m: 16 ex., MHNG 1400.24-39, 1404.2-47, 1962/1964, leg. H. Schnurrenberger (Kramer, 1977). Pokhara, 1500 m (?): 1 ex., MHNG 1404.31 (Kramer, 1977).

Field observation. — Bahundanda, 1400 m: 1 ex., 5-X-1978 by P.E. Ouboter & H. van Meeuwen.

Diagnosis. — A small to medium-sized snake; total length usually under 100 cm. Usually 10 to 12 supralabials, the first one more or less completely united with the nasal; internasals large, in contact with one another or separated by a single scale; upper headscales small, subequal; supraoculars narrow. Dorsal scales usually in 21 rows, scales more or less distinctly keeled; 152 to 176 ventrals. Dorsally bright green; a white lateral stripe on the scales bordering the ventrals. Labial region light green. Ventrally white to greenish white.

Habitat. — This species is usually found at lower altitudes and consequently in Nepal it is associated with cultivated areas. In some areas it is quite abundant (see the numbers collected by Schnurrenberger at Suikhet) and people working in the field are often bitten by it. It is mainly terrestrial and not, like the common English name bamboo pitviper might suggest, a climbing species.

Distribution. — See fig. 10. Range: northern India and the whole of Indo-China: Himachal Pradesh, Chota Nagpur, Nepal, Eastern Himalayas to southern China, Taiwan, Burma, Thailand, Malay Peninsula, Indonesia. An Indo-Chinese species, whose range extends along the Himalayas to Himachal Pradesh (NW India). Its range in the Annapurna-Dhaulagiri area is restricted to the wetter parts on the southern side of the main Himalayan chain.

Elapidae

Ophiophagus hannah (Cantor, 1836)
(fig. 10)

Hamadryas hannah Cantor, 1836: 187 (type loc. Sundarbans, near Calcutta).
Naja hannah – Smith, 1943: 436; Waltner, 1975d: 14.
Ophiophagus hannah – Swan & Leviton, 1962: 142; Fleming & Fleming, 1974: 434; Majupuria, 1981: 169.

Field observation. — 2 km N of Landrung (Niwal Dung), 1530 m: 1 ex., S 9, 14-IV-1981.

Diagnosis. — A large snake with a maximum size of at least 4.5 m. Preocular squarish, in touch with the nasal, separated from the internasal by the prefrontal; two anterior and two posterior temporals; a pair of large occipitals. Dorsal scales in 15 rows; scales on the neck in 17 to 19 rows. Scales smooth, those of the vertebral series and outer two rows larger than the others. Neck dilatable in a narrow hood. Dorsally olive-brown to black with white to yellow transverse bars; these are pointing forwards on the anterior parts of the body; on the sides of the body they expand. In old specimens the markings disappear, only on the posterior part of the body some trace of the bars remain.

Habitat. — A specimen of about 2.5 m was seen near Landrung, crossing the foothpath. The area consisted of some terraced meadows with many bushes and high grass all around. The snake escaped in some heavily overgrown bushes. According to local people two much larger specimens were sometimes seen on the other side of the hill, especially in autumn. Also in other villages in the hills local people had seen large snakes, eating other snakes. So it seems that specimens occur in low numbers at rough, inaccessible places in this area.

Distribution. — See fig. 10. Range: Peninsular India, the Himalayas, the whole of the Indo-Chinese subregion as far north as the Triangle in Upper Burma, Southern China, the Andaman Islands, the Malay Peninsula, western Indonesia and the Philippine Islands. A Panoriental species, that is known to occur in both the Western and the Eastern Himalayas (Smith, 1943) up to an altitude of 2000 m. In Nepal only recorded from the Terai (Fleming & Fleming, 1974). This is the first record from the Nepalese hills.

AMPHIBIA

Anura

Key to the families of Anura in the Annapurna-Dhaulagiri area.

1. Large parotoid glands behind the eyes ..... Bufonidae
– No parotoid glands 2
2. Toad-like in appearance with many warts or if not so upper eyelid with a sharp edge and the snout obliquely truncated in lateral profile, projecting beyond the mouth ..... Pelobatidae
– Not toad-like in appearance, skin rather smooth or with only few warts; upper eyelid without a sharp edge; snout not obliquely truncated in lateral profile, not distinctly projecting beyond the mouth 3
3. Head very small and pointed, body bullet-shaped, snout-vent length in adults not exceeding 30 mm; tympanum absent ..... Microhylidae (*Microhyla ornata*)
– Head not small, body not bullet-shaped, snout-vent length in adults usually exceeding 30 mm; tympanum usually present 4
4. Intercalary cartilages between the penultimate and ultimate phalanges; fingers slightly webbed; fingers and toes with digital pads; arboreal ..... Rhacophoridae (*Polypedatus maculatus*)
– No intercalary cartilages between the penultimate and ultimate phalanges; if the fingers and toes have digital pads, than fingers not webbed; terrestrial ..... Ranidae

Remarks: a microhylid frog which, although not yet reported, might occur in the area discussed is *Kaloula pulchra*. This species is much larger than *Microhyla ornata* and has a distinct tympanum.

Bufonidae

Key to the species of Bufonidae in the Annapurna-Dhaulagiri area.

1. Top of the head with bony ridges 2
– Top of the head without bony ridges ..... *Bufo stomaticus*
2. Bony ridges on the head black; warts with black tips; snout-vent length in adults less than 65 mm ..... *Bufo melanostictus*
– Bony ridges on the head and warts of the same colour as the rest of the

dorsum; snout-vent length in adults more than 70 mm .... *Bufo himalayanus*

Bufo himalayanus Günther, 1864
(fig. 11)

Bufo melanostictus, var. *himalayanus* Günther, 1864: 422 (type loc. Sikkim and Nepal).
Bufo himalayanus – Boulenger, 1882: 305; Boulenger, 1890: 505; Annandale, 1906: 289; Smith, 1951: 727; Smith & Battersby, 1953: 703; Swan & Leviton, 1962: 107; Dubois, 1974b: 344; Malla, 1981: 140.

Material examined. — Lumsum, 2180 m: 8 juv., RMNH 20520-27, 1 ex., field no. RMNH 0574 (Nepal), 9-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 4 km E of Lumsum, 2200 m: 1♀, RMNH 20528, 17-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 5 km E of Lumsum, 2200 m: 1 ex., field no. RMNH 0612 (Nepal), 17-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Tatopani, 1300 m: 1 ex., ZSM 185/1973, 28-V-1973, leg. U. Gruber & D. Fuchs. Ghasa, 2050 m: 5 ex., ZSM 182/1973, 29-V-1973, leg. U. Gruber & D. Fuchs. Kalopani, 2450-2500 m: 5 ex., ZSM 181/1973, 1-VI-1973, 9 ex., ZSM 186/1973, 3-VI-1973, 2 ex., ZSM 187/1973, 31-V-1973, 2 ex., ZSM 192/1973, 2-VI-1973, 4 ex., ZSM 292/1979, 3-VI-1973, all leg. U. Gruber & D. Fuchs. Sikha, 2020 m: 1 ex., field no. RMNH 0471 (Nepal), 24-V-1981, leg. L. Nanhoe & P.E. Ouboter. Ghandrung forest, 2300 m: 24 ex., ZSM 183/1973, 15-V-1973, 2 ex., ZSM 294/1979, 26-V-1973; 2360 m: 1 ex., ZSM 184/1973, 22-V-1973, all leg. U. Gruber & D. Fuchs. Dhampus forest, 2030 m: 1♂, RMNH 20519, 30-V-1981, leg. L. Nanhoe & P.E. Ouboter. Tal, 1640 m: 1♂, RMNH 20518, 3-V-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Gurjakhani, 2590 m: 1 juv., BMNH 1972.518, 24-VI-1954, 2 juv., BMNH 1972.519-20, 29-VI-1954, 1 juv., BMNH 1972.521, 6-VII-1954, all leg. K.H. Hyatt (Dubois, 1974b). Lumsum, 1980-2130 m: 1 juv., BMNH 1972.517, 21-VI-1954, 3 juv., BMNH 1972. 522-24, 11-VII-1954, all leg. K.H. Hyatt (Dubois, 1974b). Sibang (Siwang), 1830 m: 2♂, BMNH 1972.515-16, 17-VI-1954, leg. K.H. Hyatt (Dubois, 1974b). Tatopani, 1310-1400 m: 3♀, HIM 095-097, 18-VIII-1972, leg. A. Dubois (Dubois, 1974b). Kabre, 2540-2650 m: 19 tadpoles, HIM T330-348, 20-VIII-1972, leg. A. Dubois (Dubois, 1974b). Ghasa, 2050-2100 m: 1♂, 1 juv., HIM 098-099, 20-VIII-1972, 61 tadpoles, HIM T349-409, 21-VIII-1971, 24 juv., HIM 100-123, 21-VIII-1972, all leg. A. Dubois (Dubois, 1974b). Kalopani, 2540-2650 m: 12♀, 7♂, HIM 124-142, 21-VIII-1972, 110 tadpoles, HIM T410-519, 22-VIII-1972, 5♀, 2♂, HIM 143-149, 22-VIII-1972, 1♀, 1♂, HIM 183-184, 3-IX-1972, 56 tadpoles, HIM T524-579, 4-IX-1972, 2♂, HIM 185-186, 4-IX-1972, all leg. A. Dubois (Dubois, 1974b). Khobang, 2600-2610 m: 2♀, 3♂, 26 juv., HIM 150-180, 23-VIII-1972, 4 tadpoles, HIM T520-523, 23-VIII-1972, 1 juv., HIM 181, 24-VIII-1972, all leg. A. Dubois (Dubois, 1974b). Tukuche, 2640 m: 1♂, HIM 182, 25-VIII-1972, leg. A. Dubois (Dubois, 1974b). Sikha, 2440 m: 1 juv., BMNH 1972. 514, 21/28-V-1954, leg. K.H. Hyatt; 2050-2120 m: 3♀, 1♂, 73 juv., HIM 018-094, 17-VIII-1972, 117 tadpoles, HIM T213-329, 17/18-VIII-1972, all leg. A. Dubois (Dubois, 1974b). Phalate, 2280 m: 1 juv., HIM 017, 17-VIII-1972, 97 tadpoles, HIM T116-212, 17-VIII-1972, all leg. A. Dubois (Dubois, 1974b). Ulleri, 2060-2250 m: 7♀, 1♂, HIM 009-016, 14-VIII-1972, 115 tadpoles, HIM T001-115, 15-VIII-1972, leg. A. Dubois (Dubois, 1974b). Thondarkot (Chandrakot), 1640-1680 m: 1♀, HIM 008, 12-VIII-1972, leg A. Dubois (Dubois, 1974b).

Field observations. — 1 km W of Bagarchap 2060 m: 1 ex., S 34, 4-V-1981. 3 km SE of Sikha, 2100 m: 1 ex., S 43, 25-V-1981.

Diagnosis. — A large toad; snout-vent length about 77 mm in males and 90 mm in females. Top of the head deeply concave with low, blunt supraorbital ridges; tympanum very small, rather distinct. Parotoids very prominent, large, elongate, at least as long as the head. The tarso-metatarsal articulation reaches in front of the eye to the tip of the snout. Upper parts with irregular, distinctly porous warts. Dorsally dark brown. During the breeding season the flanks with red spots in both males and females. Ventrally dark grey, sometimes with black spots.

Habitat. — *B. himalayanus* replaces *B. melanostictus* at altitudes above 2000 m; in the dry valley of the Kali Gandaki and the Marsyandi also at lower altitudes (Tatopani: 1300 m; Tal: 1640 m). It is found in clearings in the forest, as well as in deforested areas below the forest. It is not recorded from altitudes above the oak forest (2700 m).

At Tal, in the beginning of May, many toads were found in amplexus in a small stream; a large number of eggs was present as well. Recently metamorphosed juveniles were seen from June till August.

Distribution. — See fig. 11. A Himalayan species. Range: Himachal Pradesh, Nepal, Sikkim/Darjeeling. In the Annapurna-Dhaulagiri region it does not occur in the dry areas north of the main Himalayan chain (Thak Khola Valley, Manang Valley).

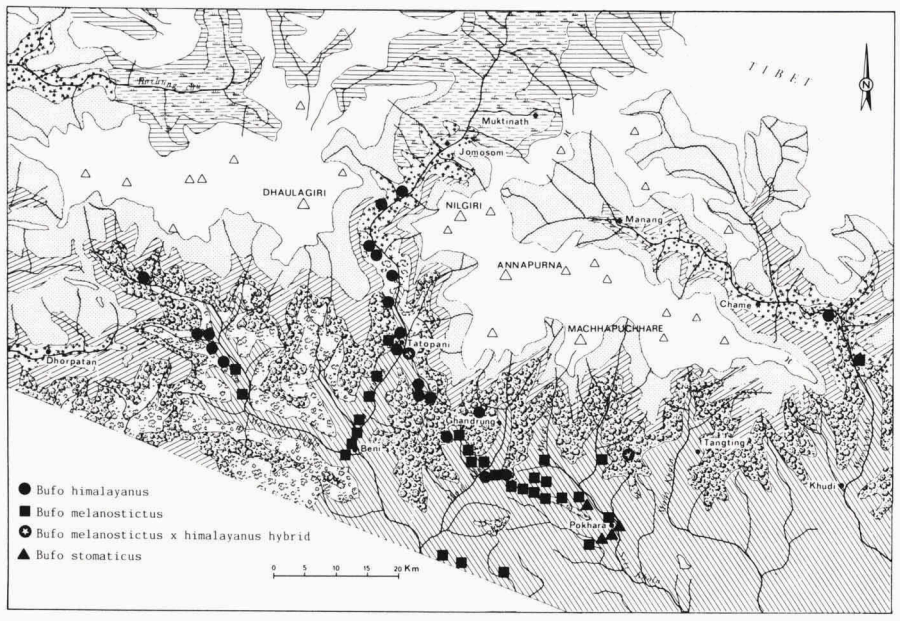

Fig. 11. The distribution of the Bufonidae. Legend see fig. 3.

Bufo melanostictus Schneider, 1799
(fig. 11)

Bufo melanostictus Schneider, 1799: 216 (type loc. India orientali); Günther, 1860: 165; Günther, 1861: 220; Boulenger, 1882: 306; Boulenger, 1890: 505; Boulenger, 1907: 149; Leviton, Myers & Swan, 1956: 4; Swan & Leviton, 1962: 107; Dubois, 1974b: 345; Malla, 1981: 140.

Material examined. — Dharapani, 1580 m: 1♂, RMNH 20534, 1 ex., field no. RMNH 0558 (Nepal), 7-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Tatopani, 1300 m: 3 ex., ZSM 163/1973, 28-V-1973, leg. U. Gruber & D. Fuchs. 1.5 km NW of Chilaune pati, 1180 m: 3 juv., RMNH 20531-32, field no. RMNH 0533 (Nepal), 2-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Khanre, 1680 m: 1 ex., ZSM -, 1979, leg. U. Gruber. Dhampus, 1800 m: 1♂, RMNH 20533, 29-V-1981, leg. L. Nanhoe & P.E. Ouboter. Indi Khola, S slope, 1250 m: 1♂, RMNH 20529, 19-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Naudanda, 1550 m: 3 ex., ZSM 152/1973, 10-V-1973, leg. U. Gruber & D. Fuchs. Pokhara, 800 m: 7 ex., ZSM 162/1973, 7-V-1973, leg. U. Gruber & D. Fuchs. Bhurjung Khola, 1280 m: 1♂, RMNH 20530, 1 ex., field no. RMNH 0377 (Nepal), 20-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Sibang (Siwang), 1830 m: 1 juv., BMNH 1972.525, 17-VI-1954, leg. K.H. Hyatt (Dubois, 1974b). Ranipauwa, 1230-1240 m: 1♀, 1 juv., MEL 189-190, 8-IX-1972, leg. A. Dubois (Dubois, 1974b). Tatopani, 1310-1400 m: 5♀, 15♂, 1 juv., MEL 154-174, 18-VIII-1972, 2♀, 8♂, 2 juv., MEL 175-187, 19-VIII-1972, 3 tadpoles, MEL T056-058, 20-VIII-1972, 1 juv., MEL 188, 6-IX-1972, 10 tadpoles, MEL T059-068, 6-IX-1972, all leg. A. Dubois (Dubois, 1974b). Modibeni, 820 m: 1♀, MEL 192, 9-IX-1972, leg. A. Dubois (Dubois, 1974b). Karkineta, 1410-1530 m: 1 juv., MEL 193, 10-IX-1972, leg. A. Dubois (Dubois, 1974b). Ulleri, 2060-2250 m: 1♀, MEL 153, 14-VIII-1972, leg. A. Dubois (Dubois, 1974b). Tikedunga, 1560-1640 m: 4♀, 3♂, MEL 146-152, 13-VIII-1972, leg. A. Dubois (Dubois, 1974b). Landbali - Tikedunga, 1320-1460 m: 1 tadpole, MEL NC001, 13-VIII-1972, leg. A. Dubois (Dubois, 1974b). Bhurungdi Khola, 1270-1300 m: 1 juv., MEL EX008, 2 juv., MEL 144-145, 13-VIII-1972, leg. A. Dubois (Dubois, 1974b). Birethanti, 1170 m: 9 juv., MEL 135-143, 13-VIII-1972, 12 tadpoles, MEL T044-055, 13-VIII-1972, leg. A. Dubois (Dubois, 1974b). Thondarkot (Chandrakot), 1640-1680 m: 17♀, 1♂, 7 juv., MEL 110-134, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Khanre - Lumle, 1660 m: 4 juv., MEL 106-109, 1 tadpole, MEL T043, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Khanre, 1730-1840 m: 1♀, 1♂, 1 juv., MEL 103-105, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Naudanda - Khanre, 1620 m: 1♀, MEL 102, 11-VIII-1972, leg. A. Dubois (Dubois, 1974b). Naudanda, 1450-1550 m: 2♀, 3 juv., MEL 097-101, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b). Leware, 1450 m: 7 juv., MEL 090-096, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b). Suikhet, 1210 m: 1♂, MEL 089, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b). Hyengja, 1200-1220 m: 42 tadpoles, MEL T001-042, 9-VIII-1972, 6♀, 5♂, MEL 077-087, 9-VIII-1972, 1♂, MEL 088, 10-VIII-1972, all leg. A. Dubois (Dubois, 1974b). Pokhara, 920-940 m: 1♀, MEL 076, 7-VIII-1972, leg. A. Dubois (Dubois, 1974b).

Field observations. — 2 km NW of Siwang, 1800 m: 1 adult, S 66, 8-VII-1981. Siwang, 1950 m: adults, S 74, 17-VII-1981. Takum, 1800 m: 1 ex., S 75, 18-VII-1981. Beni, 930 m: 1 adult, S 60, 6-VII-1981. Bhe Khola, 1100 m: 1 ex., S 79, 20-VII-1981. 4 km NE of Bhe Khola, 1120 m: juveniles, tadpoles, S 80, 21-VII-1981. 2 km N of Bheda-bari-phedi, 1150 m: 1 juv., S 58, 4-VII-1981. Bheda-bari-phedi, 1130 m: 1 ex., S 57, 2-VII-1981. Hille, 1550 m: 1 ex., S 50, 28-V-1981. 2 km E of Hille, 1300 m: 1 juv., S 51, 28-V-1981. Birethanti, 1040 m: adults, S 84, 25-VII-1981. Khanre, 1580 m: 1 ex., S 87, 26-VII-1981. Naudanda, 1450 m: 1 ex., S 88, 26-VII-1981. Phewa Tal, 960 m: 1 ex., S 53, 2-VI-1981.

Diagnosis. — A medium-sized toad; snout-vent length about 57 mm in males and 64 mm in females. Head with elevated bony ridges; tympanum

distinct, at least two-third the width of the eye. Parotoids very prominent, kidney-shaped or elliptic. First finger usually extending beyond the second. The tarso-metatarsal articulation reaches between the tympanum and the eye. Upper surfaces with more or less prominent, spiny warts. Dorsally brown to yellow-brown. Bony ridges black. Warts with black tips. Ventrally yellowish white.

Habitat. — Under 1800 m this toad can be met nearly everywhere, in the centre of a city under a street-lamp, as well as under stones in a forest clearing. Usually it is not found deep in the forest.

Breeding extends at least over the period April to July, as in both months tadpoles were observed.

Distribution. — See fig. 11 A Panoriental species. This probably is the most common toad of Asia. Range: Nepal, Sikkim/Darjeeling, India, Burma, Thailand, the western Indo-Australian Archipelago except Celebes. In the Annapurna-Dhaulagiri region it is limited to the wet cultivated zone south of the main Himalayan chain.

Hybrid **Bufo himalayanus** × **Bufo melanostictus** ?
(fig. 11)

Material examined. — 4 km SE of Sikha, 2100 m: 1♀, RMNH 20537, 23-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 5 km W of Chipli, 2170 m: 1♀, RMNH 20536, 21-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Diagnosis. — Intermediate between *B. himalayanus* and *B. melanostictus* in several characters. The bony ridges on the top of their heads are interrupted and only partly black, although both specimens have the size of full-grown *B. melanostictus*. The parotoids are intermediate between the very large parotoids of *B. himalayanus* and the medium-sized parotoids of *B. melanostictus*. Upper surfaces with prominent, spiny warts. Dorsally brown. Ventrally yellowish white.

Habitat. — They were collected at forest clearings at 2100 and 2170 m, altitudes intermediate between the altitudinal ranges of *B. himalayanus* (1300-2650 m) and *B. melanostictus* (800-2250 m).

Distribution. — See fig. 11. Hybrids between *B. himalayanus* and *B. melanostictus* probably can be found all over the Himalayas where the altitudinal ranges of these species overlap.

Remarks. — According to Annandale (1912b) "almost every gradation between the two forms can be found". This was denied by Dubois (1974b), but in 1981 he informed us (Dubois, pers. comm.) that he was aware of the existence of hybrids.

Bufo stomaticus Lütken, 1862
(fig. 11)

Bufo stomaticus Lütken, 1862: 305 (type loc. Assam); Dubois, 1974b: 345; Waltner, 1975a: 22.
Bufo andersoni (part.) Annandale, 1907b: 171; Chabanaud, 1922: 12; Leviton, Myers & Swan, 1956: 4; Swan & Leviton, 1962: 107; Minton, 1966: 52; Clark et al., 1969: 288; Waltner, 1975a: 22; Malla, 1981: 140.

Material examined. — Phewa Tal, 800 m: 17 juv., ZSM 189/1973, 7-V-1973, 2 ex., ZSM 190/1973, 8-V-1973, leg. U. Gruber & D. Fuchs. Naudanda - Pokhara, 1400 m: 11 ex., ZSM 191/1973, 22-VII-1973, leg. U. Gruber & D. Fuchs. Pokhara North, 930 m: 1♂, RMNH 20539, 2 ex., field no. RMNH 0643-44 (Nepal), 27-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Pokhara airport, 960 m: 1♀, RMNH 20538, 1 ex., field no. RMNH 0321 (Nepal), 4-IV-1981, 940 m: 1♀, 1♂, RMNH, 20540-41, 1 ex., field no. RMNH 0647 (Nepal), 27-VII-1981, all leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Pokhara airport, 920-940 m: 50♀, 51♂, 30 juv., STO 094-224, 146 tadpoles, STO T014-T159, 7-VIII-1972, 2♂, 1 juv., STO 225-227, 3♀, 4♂, STO EX001-EX007, 8-VIII-1972, 27♀, 27♂, 3 juv., STO 228-284, 12-IX-1972, all leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A small to medium-sized toad; snout-vent length about 51 mm in males and 62 mm in females. Top of the head without bony ridges; tympanum very distinct, round, two-third the diameter of the eye. Parotoids large, elliptical, flat. First finger extending as far as second or slightly beyond. The tarso-metatarsal articulation reaches between the shoulder and the eye. Upper parts with irregular, flat warts. Dorsally brown or olive-grey, spotted or marbled dark brown or dark grey. Ventrally white to grey.

Habitat. — In Pokhara and Kathmandu this species was always found in highly cultivated areas, (in the city) in gardens, buffalo-pools, etc.

Distribution. — See fig. 11. An Indian species. Range: Western Himalayas, Nepal, India, Pakistan. In Nepal only known from the Terai and the large valleys of Kathmandu and Pokhara, not from the hills. Since these valleys are completely surrounded by hills, a possible explanation for their occurrence in the valleys, is that they were accidentally brought there by man.

Pelobatidae

Key to the species of pelobatid frogs in the Annapurna-Dhaulagiri area.

1. Skin smooth; upper eyelid with a sharp edge; snout obliquely truncated, projecting beyond the mouth ..... *Megophrys parva*
– Skin with warts; upper eyelid rounded; snout not obliquely truncated, not distinctly projecting beyond the mouth 2

2. Toes distinctly webbed; snout-vent length 46.5 to 58.5 mm ..... *Scutiger alticola*
– Toes with indistinct rudiment of webbing 3
3. Head slightly wider than long; snout-vent length 44 to 61.5 mm ..... *Scutiger sikimmensis*
– Head distinctly wider than long; snout-vent length 59.5 to 74.5 mm .. *Scutiger nepalensis*

Megophrys parva (Boulenger, 1893)
(fig. 13)

Xenophrys monticola (not *Megophrys monticola* Kuhl & Van Hasselt, 1822) Günther, 1864: 414.
Xenophrys monticola (part) – Anderson, 1871a: 38; Anderson, 1871b: 200; Boulenger, 1882: 441.
Leptobrachium monticola (part) – Boulenger, 1890: 510.
Leptobrachium parvum Boulenger, 1893a: 344 (type loc. District of the Karin Bia-po, Burma).
Leptobrachium monticola – Boulenger, 1907: 149.
Megophrys parva – Kripalani, 1953; Dubois, 1974b: 353.
Rana monticola – Swan & Leviton, 1962: 108; Waltner, 1975a: 24; Malla, 1981: 140.

Material examined. — Muna, 1970 m: 2♂, RMNH 20544-45, 8-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 2 km S of Landrung, 1630 m: 2 tadpoles, RMNH 21931, 7-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Dhampus forest, 1900-1990 m: 1♀, 1♂, RMNH 20542-43, 1♂, field no. RMNH 0507 (Nepal), 29/30-V-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Ranipauwa, 1230-1240 m: sound, PRV NC004, 7-IX-1972, leg. A. Dubois (Dubois, 1974b). Kabre, 1810-1840 m: sound, PRV NC002, 20-VIII-1972, leg. A. Dubois (Dubois, 1974b). Kabre - Ghasa, 1910 m: sound, PRV NC003, 20-VIII-1972, leg. A. Dubois (Dubois, 1974b). Ghasa, 2050-2100 m: 4♂, PRV 038-041, 20-VIII-1972, leg. A. Dubois (Dubois, 1974b). Karkineta, 1410, 1530 m: 1♂, PRV 042, 10-IX-1972, leg. A. Dubois (Dubois, 1974b). Sikha, 2440 m: 1♂, BMNH 1972.527, 21/28-V-1954, leg. K.H. Hyatt; 2050-2120 m: 2♂, PRV 036-037, 17-VIII-1972, leg. A. Dubois (Dubois, 1974b). Ulleri, 1830-2130 m: 1♂, BMNH 1972.526, 18-V-1954, leg. K.H. Hyatt; 2060-2250 m: 4♂, PRV 032-035, 14-VIII-1972, leg. A. Dubois (Dubois, 1974b). Tikedunga, 1560-1640 m: 4♂, PRV 028-031, 13-VIII-1972, leg. A. Dubois (Dubois, 1974b). Thondarkot, 1640-1680 m: sound, PRV NC001, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Khanre, 1730-1840 m: 3♂, PRV 025-027, 11-VIII-1972, leg. A. Dubois (Dubois, 1974b). Naudanda, 1450-1550 m: 3♂, PRV 022-024, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A small pelobatid frog; snout-vent length about 31 mm. Head broad, depressed, rather short; snout rounded, with its extremity prominent and obliquely truncated, distinctly projecting beyond the mouth; canthus rostralis sharp; loreal region slightly concave; upper eyelid with a sharp edge; tympanum rather small; a supratympanic fold from the posterior edge of the orbit towards the armpit. Toes with a rudiment of webbing; tips of fingers and toes slightly swollen; subarticular and metatarsal tubercles indistinct. Skin

smooth; olive-brown above; a triangular dark spot between the eyes; generally one or two other markings on the back; the lateral parts of the head sometimes black.

Habitat. — This species lives at the edge of the subtropical and oak forest near streams at an altitude between 1230 and 2440 m. In daytime they are hidden in places like stone walls, bushes and deep holes, where it is impossible to locate them. They only emerge from their shelters. when it is getting dark or during rain. In the breeding season, the males were heard calling during rain or at dusk; a very obvious sound one could easily recognize.

Distribution. — See fig. 13. Range: central and eastern Nepal, Sikkim/Darjeeling. This Eastern Himalayan species probably does not occur west of the Jaljala Pass. Muna is the most western locality recorded. In the Annapurna area they do not occur in the dry valleys (Thak Khola, Manang). They are not yet recorded from the southeastern part, although habitat conditions here are the same as in the southwestern part.

Scutiger alticola (Procter, 1922)
(fig. 12)

Cophophryne alticola Procter, 1922: 583 (type loc. Kharta Valley, Tibet).
Scutiger alticola – Swan & Leviton, 1962: 136; Dubois, 1974a: 496; Dubois, 1974b: 354.

Material examined. — 4 km SW of Muktinath, 3600 m: 3♀, 4♂, RMNH 21669-75, 14-V-1981, 3570 m: 6 tadpoles, RMNH 20406, 21676-80, 14-V-1981, all leg. L. Nanhoe & P.E. Ouboter.
Literature references. — Muktinath, 3960 m: 3 adults, 2 juv., BMNH 1972.528-532, 14-IX-1958, leg. K.H. Hyatt; 5 adults, 5 juv., ALT 001-010, 1-IX-1972, 14 tadpoles, ALT T001-T014, 1-IX-1972, all leg. M. Sherpa & P. Tamang (Dubois, 1974b).

Diagnosis. — A pelobatid toad; snout-vent length 46.5-56 mm in males and 52-58.5 mm in females. Head slightly wider than long, depressed; snout rounded; canthus rostralis rounded; no tympanum. Toes with narrow webs; subarticular tubercles absent; a very small oval inner metatarsal tubercle. Skin of dorsum of reproductive males with warts on the back; black horny spines on the lateral parts of the head, the supratympanic fold, the warts and the dorsal surface of tibia and tarsus; black horny spines on the front edge of the lower jaw and on the belly; nuptial asperities on the first two fingers and the innerside of the third, on the lateral parts of the chest on each side forming two hardly separated gland-like, oval to round patches; fore-arm slightly thickened. Females with warts on the lateral parts of the back, sometimes with black horny spines on the warts, the supratympanic fold and the temporal region; sometimes some black spines on the lateral parts of the chest. Colour

in life olive-green to olive-brown on the dorsum and yellowish grey on the ventral parts.

Habitat. — This species was found near Muktinath at 3600 m, under large stones in a stream. The area is dry except for some small streams. The vegetation consists of small scrubs (e.g. *Caragana*). In May 1981 several *S. alticola* were in amplexus, and tadpoles in several stages were present at the same time, in a small pond.

Distribution. — See fig. 12. A Tibetan species. In Nepal only known from the Muktinath area. Probably occurring in the high altitude steppe of Dolpo (NW Nepal) as well.

Scutiger nepalensis Dubois, 1974
(fig. 12)

Scutiger nepalensis Dubois 1974a: 496 (type loc. Khaptar, 20 km west of Sacred lake, Dah Khaptar, Western Nepal).

Material examined. — Dhorpatan, 2920 m: 2♂, RMNH 20404-05, 2♂, field no. RMNH 0588-89 (Nepal), 11-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 2 km E of Gurja Ghat, 3070 m: 1 juv., RMNH 20399, 16-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 5 km E of Gurja Ghat, 3100 m: 1♂ subadult, RMNH 20400, 16-VII-1981, leg. L. Nanhoe & P.E. Ouboter.

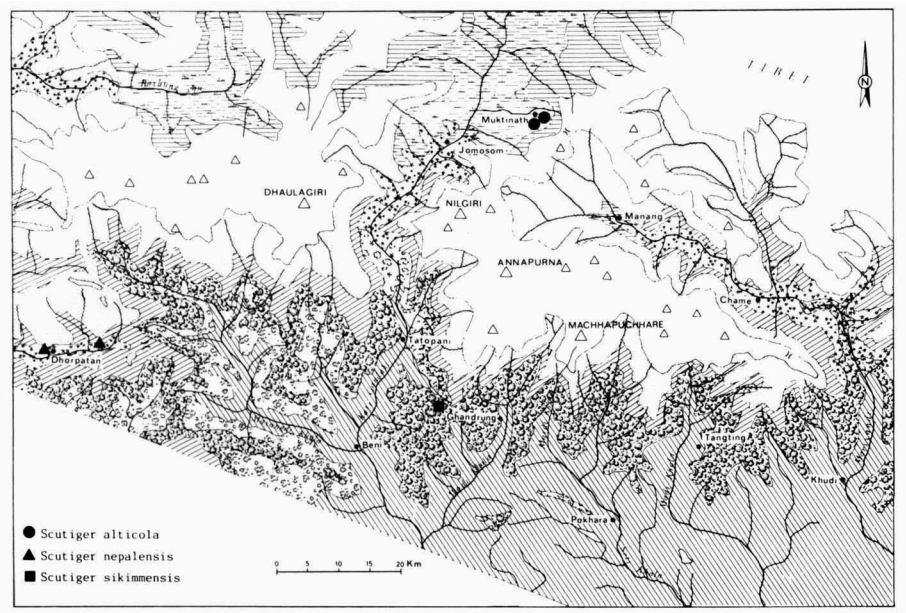

Fig. 12. Distribution of *Scutiger*. Legend see fig. 3.

Diagnosis. — A pelobatid toad with a large waist; snout-vent length 67.5-73.5 mm in males and 59.5-74.5 mm in females. Head much wider than long, the width as large as the length of the tibia in males and larger in females; snout rounded; canthus rostralis rounded; no tympanum. Toes with an indistinct rudiment of webbing; a large elliptical, very feebly prominent inner metatarsal tubercle. Skin of dorsum with many warts on the back. Reproductive males with black horny spines on the lateral parts of the head, the supratympanic folds, on and between the warts, the dorsal face of the hindlimbs and ventrally on the front edge of the lower jaw and the toes; nuptial asperities on the first and second fingers, the inner side of the third finger, the lateral parts of the chest forming two (sometimes more) round to oval patches on each side and on the anal region; forearm slightly thickened. Colour in life olive-brown to dark brown on the dorsum; ventrally yellowish grey.

Habitat. — This species was located because of the strange sound it makes, somewhat resembling that of a crow. The Dhorpatan specimens were found in a field surrounded by open pine-forest. Three specimens (males) were found, together with some eggs, in a large burrow, covered by a big stone. Two others were found under stones in a mixed coniferous and oak forest.

Distribution. — See fig. 12. Previously only known from Khaptar in western Nepal (Dubois, 1974a, 1981). Probably it does not occur east of the Jaljala Pass.

Scutiger sikimmensis (Blyth, 1854)
(fig. 12)

Bombinator sikimmensis Blyth, 1854: 300 (type loc. Sikkim).
Bombinator sikkimensis – Günther, 1860: 165; Günther, 1864: 400.
Scutiger sikkimensis – Theobald, 1868: 83; Smith, 1951: 727; Smith & Battersby, 1953: 703; Waltner, 1975a: 18.
Bufo sikkimensis – Anderson, 1871a: 38; Anderson, 1871b: 204; Stoliczka, 1872b: 103; Boulenger, 1882: 305.
Cophophryne sikkimensis – Boulenger, 1887b: 406; Boulenger, 1890: 508.
Scutiger sikkimmensis – Swan & Leviton, 1962: 108; Malla, 1981: 140.
Scutiger sikimmensis – Dubois, 1974a: 496; Dubois, 1974b: 355.

Material examined. — Ghorapani, 2850-2860 m: 2♂, 1 juv., RMNH 20401-03, 26-V-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature reference. — Ghorapani, 2800-2930 m: 10 tadpoles, SIK T001-T010, 16-VII-1972, leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A pelobatid toad; snout-vent length 44-61.5 mm in males and 47-60.5 mm in females. Head slightly wider than long; snout short, rounded;

canthus rostralis rounded; no tympanum. Toes with an indistinct rudiment of webbing; a large elliptical, very feebly prominent inner metatarsal tubercle. Skin of dorsum with many warts on the back. Reproductive males with black horny spines on the warts, the lateral parts of the head, the dorsal surfaces of the limbs and ventrally on the anterior edge of the lower jaw; granulose spines on and between the warts all over the dorsum and on the ventral surface of the fourth and fifth toe; nuptial asperities on the first and second fingers, the innerside of the third finger and on the lateral parts of the chest forming two large separated oval to round patches on each side. Colour in life greyish brown to olive-brown on the dorsum with a dark brown spot connecting the eyelids anteriorly and continuing as a vertebral band up to halfway or two-third down the back; small irregular dark brown spots on the snout, the head, the lateral parts of the back and the limbs; ventral parts yellowish to greyish white.

Habitat. — In May several specimens were found by turning stones in a small stream in dense oak/rhododendron forest, not far from a clearing; deeper inside the forest only *Rana polunini* was found in this stream. The males were in breeding condition and had very distinct spines on their back, the function of which is not known. Possibly they have a function for toads to wedge themselves between rocks in the stream. One specimen was collected under a log on the forest-floor.

Distribution. — See fig. 12. Range: central and eastern Nepal, Sikkim. This species probably is an Eastern Himalayan species. It is known from a limited number of localities only; in Nepal from Ghorapani, Jaljale Himal in the east (Dubois, 1974b) and Langtang north of the Kathmandu Valley (Smith, 1951).

Remarks. — The two specimens mentioned by Smith & Battersby (1953) for western Nepal (BMNH 1953.1.1.44-45) probably belong to *Scutiger nepalensis* instead of *S. sikimmensis*. These two species are very similar in appearance; *nepalensis* is, on the average, larger in total length and waist, and the head is relatively wider than in *sikimmensis*. Unfortunately the two specimens mentioned above are badly preserved, their size is in the zone of overlap between *nepalensis* and *sikimmensis,* so that they could not be identified with certainty.

Microhylidae

Microhyla ornata (Duméril & Bibron, 1841) (fig. 13)

Engystoma ornatum Duméril & Bibron, 1841: 745 (type loc. Côte Malabar, India).
Microhyla ornata Boulenger, 1882: 165; Boulenger, 1890: 491; Leviton, Myers & Swan, 1956: 5; Swan & Leviton, 1962: 108; Dubois, 1974b: 352; Malla, 1981: 139.

Material examined. — 200 m N of Bheda-bari-phedi, 1150 m: 1♂, RMNH 20548, 4-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Dhampus, 1430 m: 1♂, RMNH 20546, 1 ex., field no. RMNH 0511 (Nepal), 1-VI-1981, leg. L. Nanhoe & P.E. Ouboter. Naudanda, 1550 m: 6 ex., ZSM 19/1973, 10-V-1973, leg. U. Gruber.

Literature references. — Naudanda - Khanre, 1590-1600 m: 2 adults, ORN 122-123, 11-VIII-1972, 1620 m: 1 adult, ORN 124, 11-VIII-1972, all leg. A. Dubois (Dubois, 1974b). Naudanda, 1450-1550 m: sound, ORN NC003, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b). Leware, 1520 m: 2 adults, BMNH 1972.512-13, 9-VI-1954, leg. K.H. Hyatt (Dubois, 1974b). Hyengja, 1160 m: 107 tadpoles, ORN T193-299, 9-VIII-1972, 1200-1220 m: 4 tadpoles, ORN T300-303, 9-VIII-1972, all leg. A. Dubois (Dubois, 1974b). Pokhara, 920-940 m: 6♂, ORN 111-116, 7-VIII-1972, 5♂, ORN 117-121, 8-VIII-1972, all leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A small frog; snout-vent length about 19 mm. Habit moderately slender; snout obtuse, as long as or a little longer than the orbital diameter; tympanum hidden. Toes webbed at the base; tips of fingers and toes swollen into very small disks; subarticular tubercle very distinct; two small, subequal metatarsal tubercles. The tibio-tarsal articulation reaches between the shoulder and the eye. Skin smooth; reddish or greyish olive above, with a large dark marking on the back, beginning between the eyes and becoming broader as it extends to the posterior part of the body. A dark band along the lateral part of head and body. Male with a subgular vocal sac.

Habitat. — A species with a wide distribution, but limited to the subtropical zone; the highest locality recorded is at 1620 m. The specimens collected by us were found active, during rain, in a grass field and on bare ground.

Distribution. — See fig. 13. A Panoriental species. Range: Pakistan, Kashmir, India, Sri Lanka, central and eastern Nepal, Assam, Burma, southern China, Indo-China.

Ranidae

Key to the genera and subgenera of Ranidae in the Annapurna-Dhaulagiri area.

1. Toes with distinct digital pads. Mountain brooks .... genus *Amolops*

– Toes without digital pads ..... genus *Rana* 2
2. Tympanum absent ..... subgenus *Altirana (Rana parkeri)*
– Tympanum present, sometimes indistinct 3
3. Inner metatarsal tubercle very large, sharp edged, larger than the inner toe; tibio-tarsal articulation reaching between the axilla and the tympanum ..... subgenus *Tomopterna (Rana breviceps)*
– Inner metatarsal tubercle smaller, usually blunt; tibio-tarsal articulation reaching the eye or beyond 4
4. Males with distinct secondary sexual characters during the breeding season; tympanum indistinct, usually partly covered by the supra-tympanic fold, less than half the size of the eye; supra-tympanic fold straight. Mountain brooks ..... subgenus *Paa*
– Males without secondary sexual characters during the breeding season; tympanum distinct, about two-third the size of the eye; supra-tympanic fold curved along the tympanum, not covering it. Stagnant or slowly running waters ..... subgenus *Dicroglossus*

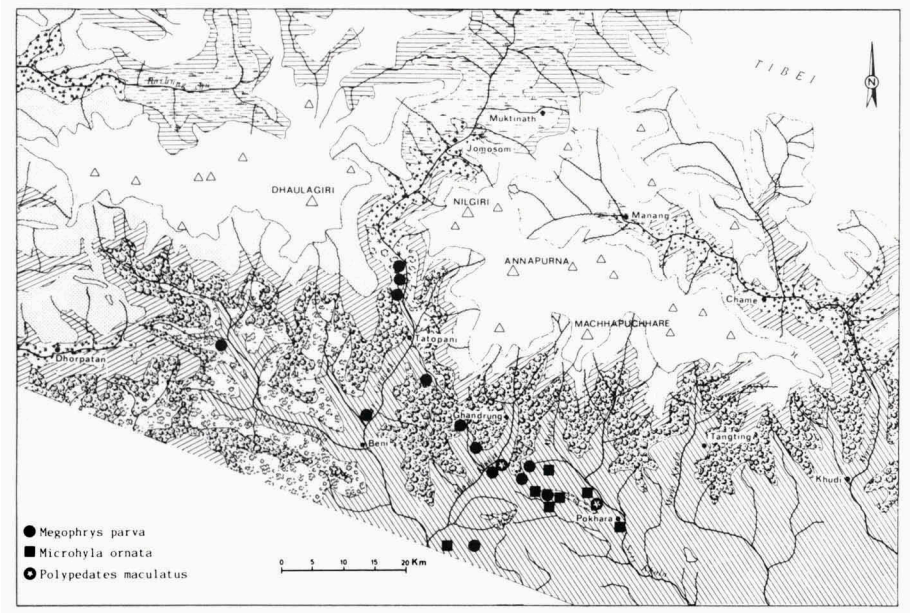

Fig. 13. Distribution of *Megophrys, Microhyla* and *Polypedates*. Legend see fig. 3.

Genus *Amolops*

Key to the species of the genus *Amolops* in the Annapurna-Dhaulagiri area.

1. Disks of fingers distinctly larger than those of the toes; skin smooth; upper parts greenish to greyish, with rounded dark brown to black spots; limbs with distinct cross-bars ..... *Amolops formosus*
– Disks of fingers as large as or slightly larger than those of the toes; skin granular; upper parts brown marbled with grey and dark brown; limbs without or with indistinct cross-bars ..... *Amolops afghanus*

Amolops afghanus (Günther, 1858)
(fig. 14)

Polypedates afghana Günther, 1858a: 81 (type loc. Afghanistan (in error)); Günther, 1864: 432.
Amolops afghanus – Cope, 1865; Dubois, 1974b: 356.
Rana afghana – Boulenger, 1882: 69; Annandale, 1912b.
Rana latopalmata Boulenger, 1882: 464; Boulenger, 1890: 462; Waltner, 1975a: 24.
Ixalus argus Annandale, 1912b: 16.
Staurois afghanus – Kripalani, 1961: 243; Swan & Leviton, 1962: 137; Waltner, 1975a: 24.

Material examined. — Tirkhedhunge, 1580 m: 1♀, RMNH 20554, 28-V-1981, leg. L. Nanhoe & P.E. Ouboter. Indi Khola, 1170 m: 1♂, RMNH 20549, 19-IV-1981, leg. L. Nanhoe & P.E. Ouboter. 0.5 km NW of Setidobhan, 1040 m: 1 ex., field no. RMNH 0526 (Nepal), 1-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Taprang (Madi Khola), 1600 m: 1♀, 1♂, 2 juv., RMNH 20550-53, 22-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Tatopani, 1310-1400 m: 2♀, AFG 049-050, 19-VIII-1972, 7 tadpoles, AFG T002-008, 19-VIII-1972, leg. A. Dubois (Dubois, 1974b). Thondarkot, 1640-1680 m: 1♀, AFG 048, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Khanre, 1730-1840 m: 1 juv., AFG NC001, 11-VIII-1972, leg. A. Dubois (Dubois, 1974b). Naudanda, 1450-1550 m: 1 juv., AFG 047, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A medium-sized frog; snout-vent length about 34 mm in males and 62 mm in females. Snout short, rounded; canthus rostralis rounded; loreal region concave; tympanum small, hardly one-third the width of the eye. Fingers depressed, not webbed; toes entirely webbed; tips of fingers and toes dilated into very large disks; subarticular tubercles large; inner metatarsal tubercle elongate, scarcely prominent; a very distinct outer metatarsal tubercle. The tibio-tarsal articulation reaches beyond the tip of the snout. Skin granular above and on the belly. Upper parts brown, marbled with grey and dark brown. Male with two internal vocal sacs.

Habitat. — This torrent frog was collected during the spring, when swimming in small streams, probably preparing to breed. Usually these streams were

close to cultivated areas. This species is only known from the subtropical zone between 1000 and 1900 m.

Distribution. — See fig. 14. Range: Eastern Himalayas from the Annapurna region (Nepal) to Yunnan. Although the name suggests different (see Annandale, 1912b), this is an Eastern Himalayan species, up till now not recorded west of the Kali Gandaki. It might occur in the catchment-area of the Mayangdi Khola as well, since the same habitat conditions occur there, but probably not west of Jaljala Pass in the drier Garhwal Himalayas. Between the Annapurna region and Sikkim it is known from a small number of localities only.

Amolops formosus (Günther, 1875)
(fig. 14)

Polypedates formosus Günther, 1875: 570 (type loc. Khassya (= Khasi Hills), India).
Rana formosa – Boulenger, 1882: 70; Boulenger, 1890: 463; Boulenger, 1907: 151; Smith, 1951: 727; Kripalani, 1952; Swan & Leviton 1962: 108; Waltner, 1975a: 23; Malla, 1981: 140.
Rana himalayana Boulenger, 1888: 507; Boulenger, 1890: 463; Acharji & Kripalani, 1951: 183.
Staurois himalayana – Liu, 1950: 345; Kripalani, 1952: 361; Kripalani, 1953; Kripalani, 1961: 243; Swan & Leviton, 1962: 137; Waltner, 1975a: 24.
Amolops formosus – Dubois, 1974b: 357.

Material examined. — Tajung Khola, 1800 m: 1♂, RMNH 20555, 15-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Ghasa, 2050-2100 m: 1♀, FOR 002, 5-IX-1972, leg. A. Dubois (Dubois, 1974b). Kalopani, 2540-2650 m: 1♂, FOR 001, 21-VIII-1972, leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A medium-sized frog; snout-vent length 52 to 66 mm. Snout flat, short, rounded; canthus rostralis distinct; loreal region concave; tympanum about one-third the diameter of the eye. Fingers very long, that of the third equalling the distance between the tympanum and the tip of the snout; fingers not webbed; toes fully webbed; fingers with large disks, larger than those of the toes; metatarsal tubercle indistinct. Skin smooth. Upper parts greenish to greyish, with rounded dark brown to black spots; limbs with distinct dark brown to black cross-bars. Male with two internal vocal sacs.

Habitat. — The single specimen from Tajung Khola was found under a large stone in an oak forest stream. This species is recorded from much drier areas with coniferous forests in the Kali Gandaki Valley as well, but always near fast running streams. While *A. afghanus* is an inhabitant of the subtropical zone, *A. formosus* appears to occur at higher altitude in the temperate zone above 1800 m.

Distribution. — See fig. 14. Probably a Himalayan species. Range: The Himalayan regions of northwestern India, Nepal, Darjeeling, northern Burma. From Nepal only few localities are known. Swan & Leviton (1962, tab. 1) listed it (as *Staurois himalayana*) as an Eastern Himalayan species.

Genus *Rana*

Subgenus *Altirana*

Rana parkeri Stejneger, 1927
(fig. 15)

Rana (Nanorana) pleskei (not of Günther, 1896) Boulenger, 1920: 107; Waltner, 1975a: 23.
Altirana parkeri Stejneger, 1927: 318 (type loc. Tingri, Tibet); Swan & Leviton, 1962: 137.
Rana (Altirana) parkeri – Dubois, 1974b: 377.

Literature reference. — Jomosom, 2790-2800 m: 1 juv., PKR 001, 29-VIII-1972, leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A small to medium-sized frog; snout-vent length 31-41 mm in males and 40-58 mm in females. Head slightly wider than long, rather strongly depressed; snout rounded, slightly projecting beyond the mouth; canthus rostralis very obtuse; loreal region very oblique, concave; no tympanum. Fingers obtuse, first as long as or slightly shorter than the second. Hindlimb rather short, the tibio-tarsal articulation reaching the shoulder or the temporal region; tibia relatively short; toes obtusely pointed, entirely or nearly entirely webbed, the distal phalanx of the fourth often free; subarticular tubercles small; inner metatarsal tubercle small, oval, about one-third the length of the inner toe. Dorsal parts with small elongate warts, which often form irregular longitudinal series or interrupted folds on the back; a supra-tympanic fold present; ventral parts smooth. Dorsally olive with numerous small blackish spots, which may have a light centre; a yellow vertebral streak sometimes present; a blackish streak from the tip of the snout to the shoulder, passing through the eye; limbs with dark spots but no cross-bars; ventrally white or spotted with black. Males without secondary sexual characters.

Habitat. — No data available.

Distribution. — See fig. 15. A Tibetan species. Jomosom is the only locality recorded for Nepal.

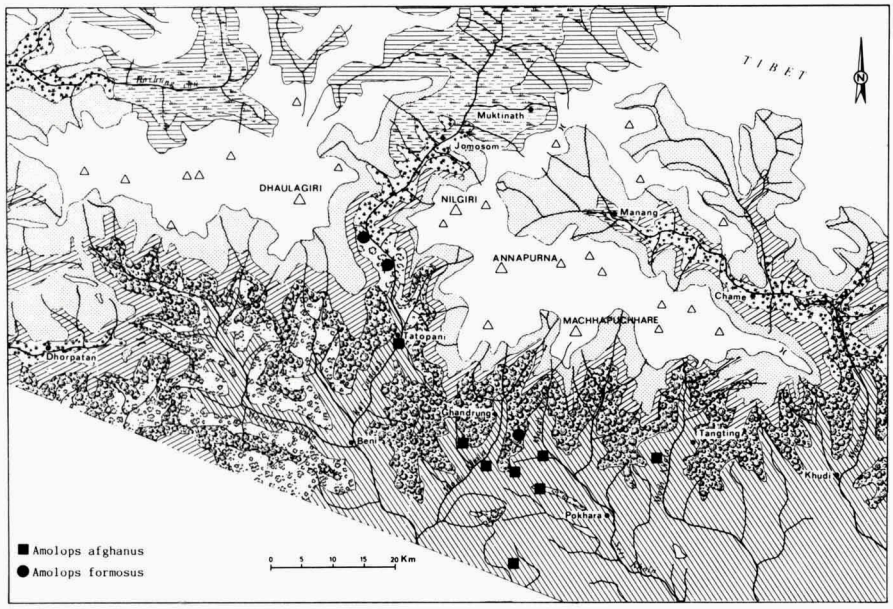

Fig. 14. Distribution of *Amolops*. Legend see fig. 3.

Subgenus *Tomopterna*

Rana breviceps Schneider, 1799
(fig. 15)

Rana breviceps Schneider, 1799: 140 (type loc. India orientali); Boulenger, 1882: 32; Boulenger, 1890: 451; Leviton, Myers & Swan, 1956: 5; Swan & Leviton, 1962: 108; Dubois, 1974b: 385; Malla, 1981: 140.
Pyxicephalus breviceps – Günther, 1864: 411.

Literature reference. — Pokhara, 920-940 m: 2♂, BRE 004-005, 7-VIII-1972, leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A medium-sized frog; snout-vent length about 63 mm in females and 50 mm in males. Head relatively short; snout rounded, occiput swollen; interorbital space narrower than upper eyelid; tympanum distinct, about two-third the diameter of the eye. Fingers moderate, obtuse, first extending much beyond the second, nearly as long as the third; toes moderate, ob-

tuse, half webbed; subarticular tubercles moderate; inner metatarsal tubercle very large, sharp-edged, shovel-shaped, longer than the inner toe. Hindlimbs relatively short, the tibio-tarsal articulation reaching between the axilla and the tympanum. Skin dorsally smooth or granulate, with some scattered tubercles or short, interrupted longitudinal folds; a strong supra-tympanic fold; belly and ventral parts of the thighs granulate. Dorsally light brown or olive, with darker spots or marblings; often a light coloured vertebral band, and sometimes another band on the upper side of each flank; throat of males blackish, of females usually spotted with brown. Male with two well-developed internal vocal sacs.

Habitat. — According to Dubois (1974b) this species is restricted to the tropical zone. No exact data are available.

Distribution. — See fig. 15. An Indian species. Range: From the Punjab and Sind to southern India and Sri Lanka, Western and Eastern Himalayas.

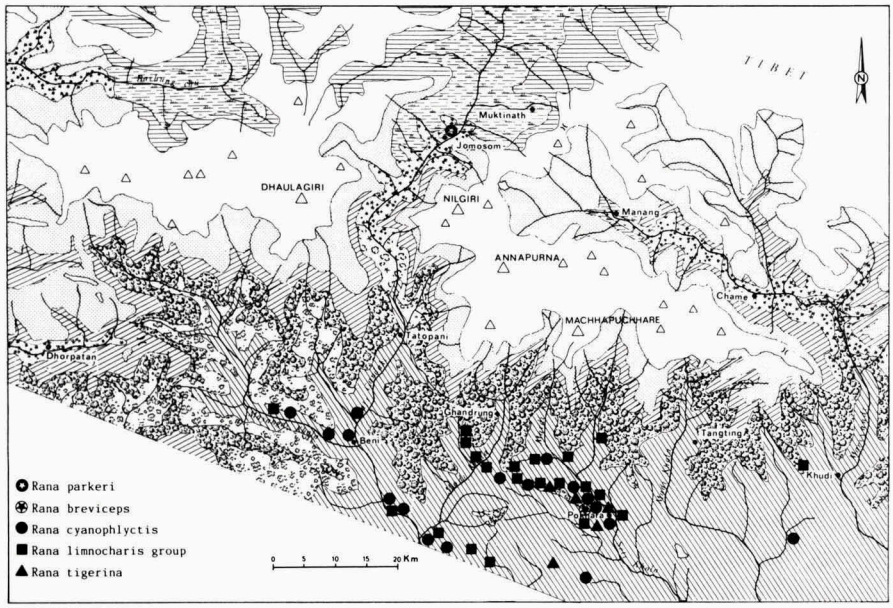

Fig. 15. Distribution of the species of *Rana* belonging to subgenera *Altirana, Tomopterna, and Dicroglossus*. Legend see fig. 3.

Subgenus *Paa*

Key to the species of the subgenus *Paa* in the Annapurna-Dhaulagiri area.

1. Snout-vent length 53 to 117 mm in adults; waist size relatively large 2
– Snout-vent length 27 top 65 mm in adults; waist small to medium-sized 3
2. Skin with pustules and granules; dorso-lateral fold often interrupted; tibia moderate; snout-vent length 53 to 117 mm in males and 61 to 117 mm in females; reproductive males with horny spines on the first three fingers, the fore- and upperarm and the metacarpal tubercle; fore-arm thickened ..... *Rana liebigii*
– Skin with granules, rarely pustules; dorso-lateral fold continuous; tibia relatively long; snout-vent length about 63 mm in males and 60 to 88 mm in females; reproductive males with horny spines on the anal region; fore-arm not thickened ..... *Rana sikimensis*
3. Head slightly to distinctly wider than long; tibia relatively long; webbing between the toes slightly concave; snout-vent length 34 to 57 mm in males and 51 to 65 mm in females ..... *Rana rostandi*
– Head slightly wider than long or as wide as long; tibia relatively short; webbing between the toes distinctly concave; snout-vent length 27 to 46 mm in males and 36 to 53 mm in females. 4
4. Skin rough, numerous warts on the back; colour grey to dark brown on dorsum; limbs with many dark cross-bars; reproductive males with thickened fore-arms ..... *Rana rara*
– Skin smooth, rarely warts on the back; colour usually olive-green on dorsum; limbs without cross-bars; reproductive males without thickened fore-arms ..... *Rana polunini*

Rana liebigii Günther, 1860
(fig. 16)

Rana liebigii Günther, 1860: 157 (type loc. Nepal); Günther, 1861: 220; Günther, 1864: 407; Boulenger, 1913: 337; Boulenger, 1920: 78; Smith, 1951: 727; Leviton, Myers & Swan, 1956: 6; Swan & Leviton, 1962: 108; Dubois, 1974b: 362; Dubois, 1976: 46; Malla, 1981: 140.
Rana gigas Peters, 1881: 87.
Rana vicina (part) Sclater, 1892a: 342.

Material examined. — Chhoya, 2500 m: 3 juv., RMNH 20585-87, 21-V-1981, leg. L. Nanhoe & P.E. Ouboter. Sihuli, 1560 m: 1♀, RMNH 20582, 14-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Dhampus forest, 2030 m: 2 juv., RMNH 20583-84, 17-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Lumsum, 1980-2130 m: 1♂, BMNH 1972.480, 12-VII-1954, leg. K.H. Hyatt (Dubois, 1976). Kalopani, 2540-2650 m: 1 juv. ♂, MNHNP 1974.1517, 21-VIII-1972, leg. A. Dubois (Dubois, 1976). Tiri: 1♀, 2 juv. ♀, MNHNP 1975.1130-1132, 19/25-V-1974, leg. J-F. Dobremez & C. Jest (Dubois, 1976). Ghorapani, 2800-2930 m: 1♀, MNHNP 1974.1516, 16-VIII-1972, leg. A. Dubois (Dubois, 1976). Ulleri, 2060-2250 m: 1 juv. ♀, MNHNP 1974.1515, 14-VIII-1972, leg. A. Dubois (Dubois, 1976).

Field observation. — Tajung Khola, 1800 m: 2 adults, S 10, 15-IV-1981.

Diagnosis. — A species with a large waist; snout-vent length 53.5-117 mm in males and 61.5-117 mm in females. Head slightly wider than long. Tibia compared to snout-vent length medium-sized. Dorso-lateral fold usually present, rather wide, often interrupted, continuing to two-third or three-fourth of the back. Skin of dorsum smooth, sometimes with pustules on the posterior half of the back and the flanks; horny granules on the back of the head, the flanks, the anal zone, the upper parts of the limbs and the soles. Reproductive males with black horny spines on the first three fingers, the thickened metacarpal tubercle, the upper arm, the dilated fore-arm and the lateral parts of the chest. Web between the toes distinctly concave; webbing formula: $1(\frac{1}{3}\text{-}1)$, $2i(1\frac{2}{3}\text{-}2)$, $2e(\frac{1}{3}\text{-}1)$, $3i(2\text{-}2\frac{1}{2})$, $3e(1\text{-}2)$, $4i(2\frac{1}{2}\text{-}3)$, $4e(3\text{-}3\frac{1}{4})$, $5(1\text{-}1\frac{3}{4})$. Colour variable, greyish brown to reddish brown.

Habitat. — This species is known from oak forest as well as coniferous forest, from 1500 to 3000 m. The porters knew exactly where to find these frogs, because they are eaten by the local people (see Shrestha, 1981). They collected them in medium-sized forest-streams under large stones. Some juveniles collected at Chhoya by local children, were found in burrows at the water's edge.

Distribution. — See fig. 16. Range: Western Himalayas (Simla, Mussoorie)?, Nepal and Eastern Himalayas (Sikkim/Darjeeling). A Himalayan or Eastern Himalayan species. According to Dubois (1976) the taxonomic position of the Western Himalayan specimens is uncertain.

Rana polunini Smith, 1951
(fig . 16)

Rana polunini Smith, 1951: 727 (type loc. Langtang Village, Nepal); Swan & Leviton, 1962: 109; Dubois, 1974a: 495; Dubois, 1974b: 368; Dubois, 1976: 116; Malla, 1981: 140.

Material examined. — 4 km SW of Muktinath, 3580 m: 1♀, 2♂, 1 juv., RMNH 20569-72, 14-V-1981, leg. L. Nanhoe & P.E. Ouboter. 1 km NW of Ghorapani pass, 2750 m: 1♀ subadult, RMNH 20559 25-V-1981, leg. L. Nanhoe & P.E. Ouboter. Ghorapani, 2860 m: 3♂, RMNH 20573-75, 26-V-1981; 2840 m: 1♀, 2♂, RMNH 20556-58, 23-VII-1981, all leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Babang, 3990 m: 1♀, MNHNP 1975.1287, 27-VIII-1972, leg. A. Dubois (Dubois, 1976). Tukuche, 2640 m: 1 juv. ♀, MNHNP 1975.1289, 2-IX-1972, leg. A. Dubois (Dubois, 1976). Thini, 3960 m: 18 juv., BMNH 1972.493-510, 18-IX-1954, leg. K.H. Hyatt (Dubois, 1974b). Kutsab Terna Tal, 2850-2910 m: 1♀, MNHNP 1975.1288, 31-VIII-1972, leg. A. Dubois (Dubois, 1976). Jomosom, 2790-2800 m: 34♀, 23♂, 37 juv., MNHNP 1975.1290-1396, 1♀, BMNH (= AD POL 195), 1♂, BMNH (= AD POL 223), 1♀, FMNH (= AD POL 250), 1♂, FMNH (= AD POL 201), 1♂, AD POL 243, 1 tadpole, POL T073, 7 tadpoles, POL T076-082, 29/30-VIII-1972, all leg. A. Dubois (Dubois, 1974b, 1976); 2750 m: 10♀, 5♂, SMF 68702-716, 21-III-1974, leg. J. Martens (Dubois, 1976). Dzar Muktinath: 3♂, MNHNP 1975.1438-1440, V-1974, leg. J-F. Dobremez & C. Jest (Dubois, 1976). Muktinath, 3960 m: 11 ex., BMNH 1972.482-492, 14-IX-1954, leg. K.H. Hyatt; 5♀, 26♂, 10 juv., MNHNP 1975.1397-1437, 1-IX-1972, leg. M. Sherpa & P. Tamang (Dubois, 1974b, 1976). Ghorapani, 2800-2930 m: 4♀, 2♂, 1 juv ♂, MNHNP 1975.1280-1286, 15-VIII-1972, 2 tadpoles, POL T074-075, 16-VIII-1972, all leg. A. Dubois (Dubois, 1974b, 1976). Tanghi (Thanja), 2680 m: 7 ex., MNHNP 1979.7747-7753, 1977, leg. P. Allirol (Dubois, 1979). Pisang, 3400 m: 20 ex., MNHNP 1979.7754-7773, 1977, leg. P. Allirol (Dubois, 1979).

Diagnosis. — A species with a small waist; snout-vent length 27.5-43 mm in males and 36-52.5 mm in females. Head usually slightly wider than long. Tibia relatively short. Dorso-lateral fold incomplete, not very distinct, sometimes interrupted, sometimes distinct only on the anterior part of the back. Skin of dorsum generally smooth, sometimes pustules abundant on the flanks and in the anal region; white granules, sometimes with a horny brown

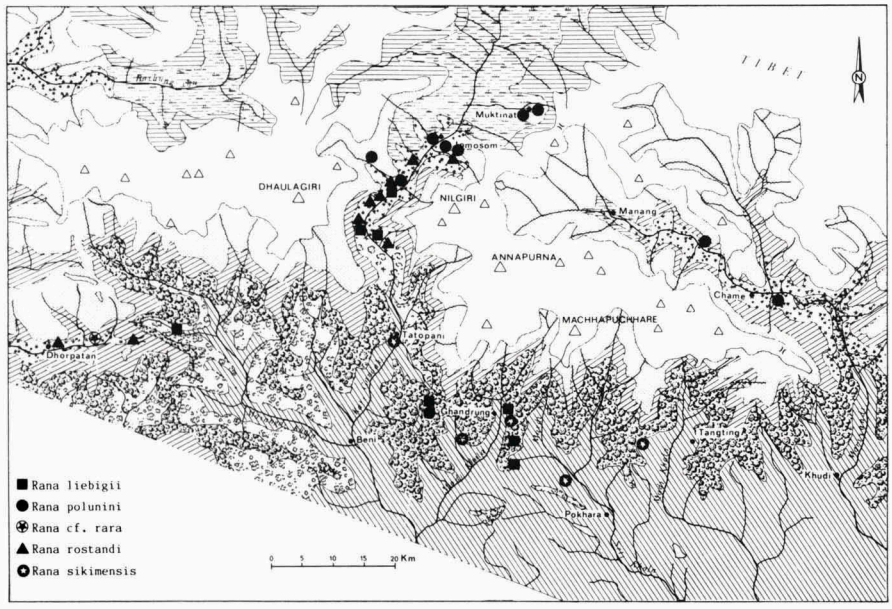

Fig. 16. Distribution of the species of *Rana* belonging to the subgenus *Paa*. Legend see fig. 3.

tip, more or less abundant, usually present on the upper eyelids and the lateral parts of the head, often on the back (in males), on the flanks, the anal region and the upper parts of the limbs, but never on the throat and chin. Reproductive males with black horny spines on the metacarpal tubercle, the first and second fingers, sometimes on the inner side of the third and rarely on the ventral side of the fore-arm and the lateral parts of the chest or the base of the upper-arm; internal vocal sacs present. Web between the toes distinctly concave; webbing formula: 1($\frac{1}{2}$-1$\frac{1}{4}$), 2i(2-1$\frac{3}{4}$), 2e($\frac{1}{2}$-1$\frac{1}{5}$), 3i(2$\frac{1}{4}$-2$\frac{4}{5}$), 3e(1$\frac{1}{4}$-2), 4i(3-3$\frac{1}{4}$), 4e(3-3$\frac{3}{5}$), 5(1$\frac{1}{4}$-2). Colour variable, in life usually olive-green.

Habitat. — This species is recorded from a variety of habitats; from the wet oak forest of Ghorapani, as well as from the dry region at Muktinath; always near small streams. The lower distributional limit is at 2610 m (Najing, Dubois, 1976), the upper limit at 3990 m (Babang).

At the end of May eggs were found in a small stream, attached to the underside of a stone separately.

Distribution. — See fig. 18. Range: western and central Nepal. A Himalayan species, with a rather disjunct distribution: one locality in far western Nepal and several localities in the Annapurna area, Langtang Valley and the Everest area (Dubois, 1976). In the Annapurna area it is the only amphibian recorded from the Manang Valley. Swan & Leviton (1962, tab. 1) have listed it as an Eastern Himalayan species since the localities in the Annapurna region and one in western Nepal (Dubois, 1976) were not known by then.

Rana cf. **rara** Dubois & Matsui, 1983
(fig. 16)

Rana rara Dubois & Matsui, 1983: 895 (type loc. Lake Rara, Western Nepal).

Material examined. — Gurja Ghat, 3020 m: 1♀, 2♂, 1 juv. RMNH 20565-68, 2 ex., 1 juv., field no. RMNH 0602-04 (Nepal), 15-VII-1981, leg. L. Nanhoe & P.E. Ouboter.

Diagnosis. — A species with a small waist; snout-vent length 36.4-45.6 mm in males and about 41 mm in females. Head as long as wide or slightly wider. Tibia compared to snout-vent length, medium-sized. Dorso-lateral fold interrupted, distinct on the anterior part of the back. Skin of dorsum rough, covered with numerous small warts; white spinules, sometimes horny, present on the lateral parts of the head, the upper eyelids, the supra-tympanic folds, the dorso-lateral folds and the warts. Reproductive males with strongly thickened fore-arms; black horny spines on the metacarpal tubercle, the first

and second fingers and the innerside of the third, the ventral surfaces of the upper- and fore-arm and the lateral parts of the chest; internal vocal sacs present. Web between toes distinctly concave; webbing formula: 1($1\frac{1}{3}$-$1\frac{1}{2}$), 2i(2-$2\frac{1}{4}$), 2e(1-$1\frac{1}{4}$), 3i($2\frac{1}{2}$-$2\frac{2}{3}$), 3e($1\frac{3}{4}$-2), 4i(3-$3\frac{1}{2}$), 4e($3\frac{1}{3}$-$3\frac{1}{2}$), 5($1\frac{3}{4}$-2). Colour in life: dorsally greyish to dark brown, sometimes with yellow to orange patches; tympanic zone dark brown to black; limbs with many narrow cross-bars; ventrally grey to dark brown.

Habitat. — The specimens collected at Gurja Ghat were found in mixed oak-pine forest under stones and trunks.

Distribution. — See fig. 16. A species endemic to the Central Himalayas. Only known from two localities in western Nepal (Lake Rara and Gurja Ghat).

Remarks. — Dubois & Matsui (1983) published their article on *Rana rara* during the preparation of this manuscript. Already aware that the specimens of Gurja Ghat concerned an undescribed taxon, we tentatively referred them to this species, since their characters agree with those presented for *R. rara*. Unfortunately, we were unable to compare the specimens mentioned above with the types of *R. rara,* because of limited time.

Rana rostandi Dubois, 1974
(fig. 16)

Rana rostandi Dubois, 1974a: 495 (type loc. Kutsab Terna Tal, Annapurna area, Central Nepal); Dubois, 1974b: 370; Dubois, 1976: 159.

Material examined. — Dhorpatan, 2900 m: 1♀, RMNH 20576, 11-VII-1981, 2920 m: 1♀, 1♂, RMNH 20577-78, 11-VII-1981, 2950 m: 1♀, RMNH 20579, 11-VII-1981, 2900 m: 1♀, RMNH 20580, 14-VII-1981, all leg. L. Nanhoe & P.E. Ouboter. Jaljala Pass, 3350 m: 1♀, RMNH 20581, 16-VII-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Dhorpatan, 3000 m: 18♀, 18♂, SMF 68601-36, III-1973, 4 tadpoles, SMF 70005-08, III-1973, all leg. J. Martens; 3500 m: 1♂, MNHNP 1975.994, V-1974, leg. S. Tamang (Dubois, 1976). Chhoya, 2400 m: 1♀, 3♂, SMF 68682-85, 25-II-1974, leg. J. Martens (Dubois, 1976). Kalopani, 2540-2650 m: 2♂, MNHNP 1975.959-962, 21-VIII-1972, 2 tadpoles, ROS T001-02, 21-VIII-1972, 1♀, 2♂, MNHNP 1975.963-965, 22-VIII-1972, 1 juv., ROS 070, 3-IX-1972, all leg. A. Dubois (Dubois, 1974b, 1976). Larjung, 2600 m: 1 tadpole, ROS T003, 23-VIII-1972, leg. A. Dubois (Dubois, 1974b). Khobang, 2600-2610 m: 1♀, 2♂, 2 juv., MNHNP 1975.966-970, 23-VIII-1972, 17 tadpoles, ROS T004-020, 23-VIII-1972, all leg. A. Dubois (Dubois, 1974b, 1976). Tukuche, 2640 m: 1♀, 1♂, MNHNP 1975.971-972, 1♂, AD ROS 018, 1♂, BMNH (= AD ROS 019), 4♂, 8 juv., MNHNP 1975.973-984, 1♂, AD ROS 032, 1♂, FMNH (= AD ROS 033), 4♂, 1 juv., MNHNP 1975.985-989, all 25-VIII-1972, 2 juv., ROS 068-069, 2-IX-1972, all leg. A. Dubois (Dubois, 1974b, 1976). Marpha, 2750 m: 1♀, MNHNP 1975.990, 28-VIII-1972, leg. A. Dubois (Dubois, 1976). Kutsab Terna Tal, 2850-2910 m: 21 tadpoles, ROS T021-041, 31-IX-1972, 18♀, 3♂, 7 juv., MNHNP 1973.310-337, 31-VIII-1972, 2 tadpoles, ROS T042-043, 1-IX-1972, all leg. A. Dubois (Dubois, 1974b, 1976).

Diagnosis. — A species with a medium-sized waist; snout-vent length 34.5-56.5 mm in males and 51-65 mm in females. Head usually distinctly wider than long, especially in females. Tibia relatively long. Dorso-lateral fold quite often interrupted, often only reaching the middle of the back. Skin with rounded pustules on the flanks and the back; small granules often with a black horny top, always on the upper eyelids, the dorsal parts of the hindlimbs and often also on the lateral parts of the body, the anterior and ventral part of the head, the back, the flanks and the dorsal parts of the fore-limbs. Reproductive males with black horny spines on the metacarpal tubercles, the first and second fingers, rarely on the ventral part of the fore-arm, which is distinctly enlarged; internal vocal sacs present. Web between the toes slightly concave; webbing formula: 1($\frac{1}{3}$-1), 2i(1$\frac{1}{2}$-2), 2e($\frac{1}{3}$-$\frac{2}{3}$), 3i(2-2$\frac{1}{2}$), 3e(1-1$\frac{1}{2}$), 4i(2$\frac{1}{3}$-3), 4e(2$\frac{3}{4}$-3), 5($\frac{2}{3}$-1$\frac{1}{2}$). Colour variable, grey to reddish brown.

Habitat. — This species is limited to coniferous forests. The specimens collected at Dhorpatan were found under stones and sometimes were located because they were calling (in daytime). The altitudinal distribution is about the same as for *R. polunini,* 2400-3500 m.

Distribution. — See fig. 16. A species endemic to the Central Himalayas. Up till now only recorded from the Kali Gandaki Valley (Thak Khola Valley) and Dhorpatan. Probably also occurring farther west.

Rana sikimensis Jerdon, 1870
(fig. 16)

Rana sikimensis Jerdon, 1870: 83 (type loc. Darjeeling); Dubois, 1976: 190.
Rana gammii Anderson, 1871a: 21.
Rana assamensis Sclater, 1892a: 343; Boulenger, 1920: 80; Swan & Leviton, 1962: 137; Dubois, 1974b: 365; Waltner, 1975a: 24.

Material examined. — Tirkhedhunge, 1580 m: 4 tadpoles, RMNH 21953, 28-V-1981, leg. L. Nanhoe & P.E. Ouboter. Sihuli, 1560 m: 2 tadpoles, RMNH 21934, 14-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Chipli Khola, 1770 m: 2 tadpoles, RMNH 21944, 21-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Tatopani, 1310-1400 m: 1♀, AD ASS 004, 18-VIII-1972, 1♂, MNHNP 1974.1502, 19-VIII-1972, leg. A. Dubois (Dubois, 1974b, 1976). Tikedunga, 1560-1640 m: 3♀, MNHNP 1974. 1499-1501, 13-VIII-1972, leg. A. Dubois (Dubois, 1976). Suikhet, 1210 m: 2 juv. ♂, MNHNP 1974.1505-1506, 25-V-1974, leg. J-F. Dobremez & C. Jest (Dubois, 1976).

Diagnosis. — A species with a large waist; snout-vent length about 63 mm in males and 60.5-88 mm in females. Head slightly longer than wide. Tibia relatively long. Dorso-lateral fold narrow, continuous. Skin of dorsum usually smooth, sometimes some pustules on the back and the flanks; white

granules or spines on the dorso-lateral fold, the back, the pustules on the flanks, the lateral and ventral parts of the head and the upper surfaces of the limbs. Reproductive males with nuptial spines on the limbs and the chest; the fore-arms not thickened; anal region with bowed and pointed horny spines; internal vocal sacs present. Web between the toes slightly concave; webbing formula: 1($\frac{1}{3}$-$\frac{2}{3}$), 2i(1$\frac{2}{3}$-2), 2e($\frac{1}{3}$-$\frac{1}{2}$), 3i(2-2$\frac{1}{3}$), 3e($\frac{1}{2}$-1), 4i(2$\frac{1}{3}$-2$\frac{2}{3}$), 4e(2$\frac{2}{3}$-3), 5($\frac{2}{3}$-1$\frac{1}{3}$). Colour in life: dorsum usually greenish brown to reddish brown; usually a dark brown V-shaped mark on top of the head; brown or green cross-bars on the upper parts of the limbs.

Habitat. — In April and May tadpoles were found in pools of quiet streams, just below the oak forest.

Distribution. — See fig. 16. Range: central and eastern Nepal, Sikkim/Darjeeling. An Eastern Himalayan species with a very disjunct distribution in Nepal. East of the Arun Valley (eastern Nepal) and in the Annapurna region many localities are known, but only one in between.

Subgenus *Dicroglossus*

Key to the species of the subgenus *Dicroglossus* in the Annapurna-Dhaulagiri area.

1. First finger extending beyond the second; inner metatarsal tubercle small or large, blunt or shovel-shaped, oval or elliptical; skin with warts on the dorsum and short longitudinal folds on the back; often a light vertebral line or band 2
– First finger not extending beyond the second; inner metatarsal tubercle small, conical, much like a rudimentary toe; skin with small tubercles and warts on the dorsum; no light vertebral line or band .... *Rana cyanophlyctis*
2. Snout-vent length about 27 to 56 mm in adults; subarticular tubercles distinctly prominent; outer metatarsal tubercle present; toes usually half-webbed, rarely two-third ..... *Rana limnocharis* group
– Snout-vent length about 165 mm in adults; subarticular tubercles moderate; outer metatarsal tubercle absent; toes nearly entirely webbed ..... *Rana tigerina*

Rana cyanophlyctis Schneider, 1799
(fig. 15)

Rana cyanophlyctis Schneider, 1799: 137 (type loc. India orientali); Günther, 1864: 406; Boulenger, 1882: 17; Boulenger, 1890: 442; Boulenger, 1907: 150; Leviton, Myers & Swan, 1956: 5; Kripalani, 1961: 241; Swan & Leviton, 1962: 108; Dubois, 1974b: 378.

Material examined. — Churtini (W of Beni), 980 m: 2♀, RMNH 20597-98, 6-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Armadi (Kali Gandaki), 860 m: 1♀, 1 juv., RMNH 20595-96, 4-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 0.2 km N of Bheda-bari-phedi, 1150 m: 2♀, RMNH 20593-94, 4-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Indi Khola, 1110 m: 1♀, RMNH 20592, 19-IV-1981, leg. L. Nanhoe & P.E. Ouboter. 1 km E of Suikhet, 1100 m: 2 juv., RMNH 20590-91, 5-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Beni, 910 m: 1 ex., BMNH 1972.479, 16-VI-1954, leg. K.H. Hyatt (Dubois, 1974b). Ranipauwa, 1230-1240 m: 1 adult, CYA NC010, 7-IX-1972, leg. A. Dubois (Dubois, 1974b). Kaneagats, 850-900 m: 1♀, CYA 130, 8-IX-1972, leg. A. Dubois (Dubois, 1974b). Modibeni, 820 m: 2♀, 1 juv., CYA 131-133, 9-IX-1972, leg. A. Dubois (Dubois, 1974b). Malyangdi Khola, 980-1190 m: 1 juv., CYA 134, 10-IX-1972, leg. A. Dubois (Dubois, 1974b). Karkineta - Siatidoban, 970-1350 m: 3 juv., CYA 135-137. 11-IX-1972, 1 juv., CYA EX 051, 11-IX-1972, all leg. A. Dubois (Dubois, 1974b). Syangja, 980 m: 1 juv., CYA EX 052, 11-IX-1972, leg. A. Dubois (Dubois, 1974b). Khanre-Lumle, 1660 m: 1♂, CYA 129, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Naudanda-Khanre, 1590-1600 m: 1♂, 1 juv., CYA 127-128, 11-VIII-1972, 1 tadpole, CYA T009, 11-VIII-1972, leg. A. Dubois (Dubois, 1974b). Yangdi Khola, 1220 m: 8♀, 12♂, 14 juv., CYA 093-126, 10-VIII-1972, 3 tadpoles, CYA T006-008, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b). Hyengja, 1160 m: 1 ex., CYA NC009, 9-VIII-1972, 1200-1220 m: 1 juv., CYA 092, 9-VIII-1972, leg. A. Dubois (Dubois, 1974b). Hyengja - Yangdi, 1100 m: 2♂, CYA 090-091, 9-VIII-1972, leg. A. Dubois (Dubois, 1974b). Yangdi - Pokhara, 1020-1030 m: 3 ex., CYA NC006-008, 9-VIII-1972, leg. A. Dubois (Dubois, 1974b). Pokhara, 920-960 m: 9 juv., CYA 138-146, 12-IX-1972, leg. A. Dubois (Dubois, 1974b). Bangre, 760 m: 6 adults, BMNH 1972. 473-478, 3-V-1954, leg. K.H. Hyatt (Dubois, 1974b).

Field observations. — Myangdi Khola, 1040 m: adults, S 62, 6-VII-1981. 2 km W of Beni, 950 m: adults, S 61, 6-VII-1981. 1 km NW of Setidobhan, 1040 m: 1 adult, S 54, 1-VII-1981. 3 km E of Suikhet, 1080 m: adults, S 91, 27-VII-1981. Hyengja, 1070 m: adults, S 92, 27-VII-1981.

Diagnosis. — A medium-sized frog; snout-vent length about 30-50 mm. Snout slightly pointed; canthus rostralis indistinct; interorbital space much narrower than the upper eyelid; tympanum distinct. Fingers slender, first not extending beyond the second; toes webbed to the tips; inner metatarsal tubercle small, conical, much like a rudimentary toe; the tibio-tarsal articulation generally just reaches beyond the eye. Skin with small tubercles and warts on the dorsum. Colour, dorsally brown to olive-grey, marbled or spotted with dark brown to black; usually two blackish streaks on the dorsal part of the thighs; ventrally white or speckled with black. Male with vocal sacs.

Habitat. — The most common frog in Nepal. Especially in the rice-growing-season, from July through September, it is very abundant in the sawahs. In March mostly juveniles were seen. The specimens of Churtini were found in a buffalo pool with an estimated water-temperature between 30 and

40°C. Characteristic for this species is its habit to skip away over the water-surface when approached.

Distribution. — See fig. 15. A Panoriental species. Range: south Arabia and Baluchistan to the Malay Peninsula, from the Himalayas to Sri Lanka. In Nepal it is associated with the cultivated zone at low altitude (760-1660 m), south of the main Himalayan chain.

Rana limnocharis group Annandale, 1917
(fig. 15)

Rana limnocharis Gravenhorst, 1829: 42 (type loc. Java, Indonesia); Wiegmann, 1835: 255; Sclater, 1892b: 6; Boulenger, 1907: 151; Leviton, Myers & Swan, 1956: 6; Kripalani, 1961: 242; Swan & Leviton, 1962: 108; Dubois, 1974b: 382; Dubois, 1975: 1717; Malla, 1981: 140.
Rana limnocharis group - Annandale, 1917: 131 (in part); Dubois, 1974b: 382.
Rana limnocharis syhadrensis Annandale, 1919.
Rana syhadrensis – Dubois, 1974b: 383; Dubois, 1975: 1717.
Rana nepalensis Dubois, 1975: 1717.
Rana pierrei Dubois, 1975: 1717.

Material examined. — 0.2 km N of Bheda-bari-phedi, 1150 m: 1♀, RMNH 21963, 4-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Karkineta, 1710 m: 3♀, RMNH 21960-62, 3 ex., field no. RMNH 0538-40 (Nepal), 2-VII-1981, leg. L. Nanhoe & P.E. Ouboter. 1 km NW of Chilaune pati, 1180 m: 1 juv., RMNH 21959, 2-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Ohiya (4 km NW of Setidobhan), 1070 m: 1♂, RMNH 21958, 1 ex., field no. 0528 (Nepal), 1-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Tirkhedhunge, 1580 m: 1 ex., field no. RMNH 0641 (Nepal), 25-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Hille, 1550 m: 1 juv., RMNH 21954, 28-V-1981, leg. L. Nanhoe & P.E. Ouboter. Dhampus forest, 2030 m: 1♂, RMNH 21955, 1 ex., field no. RMNH 0509 (Nepal), 31-V-1981, leg. L. Nanhoe & P.E. Ouboter. Indi Khola, 1130 m: 1♀, RMNH 21937, 19-IV-1981, 1110 m: 3 juv., RMNH 21938-40, 19-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Mardi Khola, 1100 m: 1 juv., RMNH 21941, 19-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Naudanda, 1550 m: 6 ex., ZSM 24/1973, 1973, leg. U. Gruber & D. Fuchs. 1 km W of Suikhet, 1100 m: 1♂, RMNH 21929, 5-IV-1981, leg. L. Nanhoe & P.E. Ouboter. Suikhet - Pokhara, 1100 m: 2 ex., ZSM 23/1973, 1973, leg. U. Gruber & D. Fuchs. Phewa Tal, 960 m: 1♀, RMNH 21956, 2-VI-1981, leg. L. Nanhoe & P.E. Ouboter. Bhurjungkhola, 1280 m: 1♂, RMNH 21942, 20-IV-1981, leg. L. Nanhoe & P.E. Ouboter.

Literature references. — Kaneagats, 850-900 m: 2♂, SYH 243-244, 8-IX-1972, leg. A. Dubois (Dubois, 1974b). Kaneagats - Armadi, 820 m: 2♀, 3♂, SYH 245-249, 9-IX-1972, leg. A. Dubois (Dubois, 1974b). Modibeni, 820 m: 1♀, 1 juv., SYH 250-251, 9-IX-1972, leg. A. Dubois (Dubois, 1974b). Malyangdi Khola, 980-1190 m: 1 juv., SYH 252, 10-IX-1972, leg. A. Dubois (Dubois, 1974b). Karkineta, 1410-1530 m: 3♀, 3 juv., SYH 253-258, 10-IX-1972, leg. A. Dubois (Dubois, 1974b). Karkineta - Siatidoban, 970-1350 m: 1 juv., SYH NC004, 11-IX-1972, leg. A. Dubois (Dubois, 1974b). Tikedunga, 1560-1640 m: 1♀, 2♂, SYH 240-242, 13-VIII-1972, leg. A. Dubois (Dubois, 1974b). Tikedunga - Landbali, 1320-1460 m: sounds, SYH NC003, 13-VIII-1972, leg. A. Dubois (Dubois, 1974b). Birethanti, 1170 m: 12 juv., SYH 228-239, 16 tadpoles, SYH T018-033, 13-VIII-1972, leg. A. Dubois (Dubois, 1974b). Thondarkot, 1640-1680 m: 2 tadpoles, SYH T016-017, 5♀, 1♂, SYH 222-227, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Lumle - Khanre, 1660 m: 1 tadpole, SYH T015, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Khanre, 1730-1840 m: 1♀, SYH 221, 11-VIII-1972, leg. A. Dubois (Dubois, 1974b). Khanre - Naudanda, 1590-1600

m: 2♀, 7♂, 10 juv., SYH 202-220, 11-VIII-1972, 2 tadpoles, SYH T013-014, 11-VIII-1972, leg. A. Dubois (Dubois, 1974b). Naudanda, 1450-1550 m: 4♀, 1♂, SYH 197-201, 11-VIII-1972, leg. A. Dubois (Dubois, 1974b). Yangdi Khola, 1220 m: 2♀, 7♂, SYH 188-196, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b). Suikhet - Hyengja, 1200 m: 1 juv., SYH 187, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b). Hyengja, 1160 m: 1♀, SYH 186, 9-VIII-1972, leg. A. Dubois (Dubois, 1974b). Hyengja - Yangdi, 1100 m: 1♂, SYH 185, 9-VIII-1972, leg. A. Dubois (Dubois, 1974b). Yangdi - Pokhara, 1020-1030 m: 1 tadpole, SYH NC002, 9-VIII-1972, leg. A. Dubois (Dubois, 1974b). Pokhara, 920-940 m: 6♂, SYH 178-183, 7-VIII-1972, 1♂, SYH 184, 8-VIII-1972, leg. A. Dubois (Dubois, 1974b). Ghampokhara, 1830 m: 1♀, BMNH 1972.481, 2-V-1954, leg. K.H. Hyatt (Dubois, 1974b).

Field observations. — Babio Chaur, 1140 m: 1 adult, S 76, 19-VII-1981. 4 km E of Babio Chaur, 1080 m: 1 adult, S 77, 19-VII-1981. Lumle, 1550 m: 1 adult, S 86, 26-VII-1981. 3 km E of Suikhet, 1080 m: 1 adult, S 90, 27-VII-1981.

Diagnosis. — The frogs of this group are small to medium-sized; snout-vent length between 27 and 56 mm. Head usually slightly longer than wide; snout rounded to slightly pointed; canthus rostralis obtuse; loreal region oblique; tympanum distinct; interorbital space much narrower than the upper eyelid. First finger extending beyond the second; subarticular tubercles of fingers and toes well-developed and very prominent; toes usually half webbed, rarely two-third; inner metatarsal tubercle oval or elliptical, one-third or two-third the length of the inner toe; outer metatarsal tubercle present; tibio-tarsal articulation reaching between the eye and the nostril. Skin dorsally with more or less prominent warts, with short longitudinal folds on the back; Dorsally grey to brown or olive, sometimes with reddish patches on the back; a narrow to broad yellowish vertebral line often present; lips with dark vertical bars; limbs with complete or more often incomplete dark cross-bars; sides of thighs yellow, marbled with black. Ventrally white or yellowish white. Males with vocal sacs, forming loose folds on the throat, which is brown or blackish.

Habitat. — Found in man-made ponds and channels, sometimes in rice-fields, but less often than *R. cyanophlyctis* and *R. tigerina*.

Distribution. — See fig. 15. This species group is widely distributed in Southern Asia. Range: The Himalayas, Nepal, Sikkim, the whole of India, Sri Lanka, Burma to the Malay Peninsula, Indonesia, China and Southern Japan.

Remarks. — There has been much confusion about the authorship of the name *limnocharis* (see Inger, 1954 and Dubois, 1974b). Gravenhorst (1829) was the first one to mention the name in a valid publication (on page 42). A specimen originating from Java, that he obtained from de Haan under the name *Ranae limnocharis,* is described by Gravenhorst as *Ranae cancrivorae.* De Haan knew the name *limnocharis* from a manuscript by Boie. Due to unfortunate circumstances Boie's manuscript was never published. Although, according to Inger (1954) who saw the original manuscript in the RMNH,

Boie really described *Rana limnocharis,* a manuscript does not meet the criteria for a valid publication of the International Commission on Zoological Nomenclature (see Article 8 of the Code). Gravenhorst (1829) published the name *Ranae limnocharis* as a junior synonym of *Ranae cancrivorae.* According to the International Code of Zoological Nomenclature the name is available (Article 11e). The author is the person who published it as a synonym, even if some other originator is cited, and is not the person who subsequently adopted it as a valid name (Article 50g). Consequently in this case the author is Gravenhorst (1829) and not Boie or Wiegmann (1835), who was the first one to use it as a valid name.

According to Dubois (1975) the *limnocharis* species group consists of four species in Nepal, i.e. *Rana limnocharis* s.s. *Rana syhadrensis, Rana nepalensis* and *Rana pierrei.* In view of the distribution areas given by Dubois (1975), the specimens occurring in the Annapurna-Dhaulagiri area, could belong to *Rana syhadrensis* or *Rana nepalensis.* These two species are separated by Dubois (1975), mainly on the basis of the calls of the males. In addition small morphological differences seem to exist in the average size of the waist, the length of the thighs, the length of the head and the colouration. There is, however, much or complete overlap between these two species in the figures presented by Dubois (1975). In the specimens collected by us, no distinct morphological differences could be found, and their identification remains uncertain.

Rana tigerina tigerina Daudin, 1802
(fig. 15)

Rana tigerina Daudin, 1802: 42 (type loc. Bengalen, Bangladesh/India); Leviton, Myers & Swan, 1956: 14; Dubois, 1974b: 381.

Rana tigrina Günther, 1858a: 9; Günther, 1860: 164; Günther, 1861: 220; Günther, 1964: 407; Boulenger, 1907: 151; Boulenger, 1920: 19; Swan & Leviton, 1962: 109; Waltner, 1975a: 23; Malla, 1981: 140.

Material examined. — 0.5 km E of Setidobhan, 1020 m: 2 juv., RMNH 20590-91, 2 tadpoles, RMNH 21957, 1-VII-1981, leg. L. Nanhoe & P.E. Ouboter. Phewa Tal, 940 m: 1 ex., ZSM 30/1973, 8-V-1973, leg. U. Gruber & D. Fuchs.

Literature references. — Naudanda - Khanre, 1590-1600 m: 2 ex., TIG 202-203, 11-VIII-1972, leg. A. Dubois (Dubois, 1974b). Yangdi Khola, 1220 m: 1 ex., TIG NC002, 10-VIII-1972, leg. A. Dubois (Dubois, 1974b). Hyengja, 1160 m: 1 ex., TIG 201, 9-VIII-1972, leg. A. Dubois (Dubois, 1974b). Pokhara, 920-940 m: 5 ex., TIG 035-039, 7-VIII-1972, 55 tadpoles, TIG T001-055, 160 juv., 1 adult, TIG 040-200, 8-VIII-1972, 3 ex., TIG 204-206, 12-IX-1972, all leg. A. Dubois (Dubois, 1974b). Phewa Tal, 760 m: 1 ex., BMNH 1972.511, 7-V-1954, leg. K.H. Hyatt (Dubois, 1974b).

Diagnosis. — A rather large frog; snout-vent length about 165 mm. Snout

more or less pointed; interorbital space narrower than the upper eyelid; tympanum distinct. Fingers rather short, first extending beyond second; toes nearly entirely webbed; a membranous fringe along the outer side of the fifth toe; inner metatarsal tubercle very variable, small or large, blunt or shovel-shaped; the tibio-tarsal articulation reaches the eye or a little beyond. Skin of dorsum with longitudinal folds on the back; a strong supra-tympanic fold. Colour dorsally brown or olive with dark brown to black spots; often a light vertebral line. Male with subgular vocal sacs.

Habitat. — This species is common in rice-fields and ponds.

Distribution. — See fig. 15. A Panoriental species. Range: Western Himalayas, India, Nepal, Sri Lanka, Assam, Burma, southern Yunnan, from China to the Malay Peninsula and Indonesia. In the Annapurna-Dhaulagiri region only recorded from the Pokhara Valley and its vicinity and from rivers south of this valley (Andhi Khola). It is common in lowland Nepal.

Rhacophoridae

Polypedates maculatus (Gray, 1834)
(fig. 13)

Hyla maculata Gray, 1834: pl. 82 (type loc. Bengal, India and Bangladesh).
Polypedates maculatus – Günther, 1860: 165; Günther, 1861: 220; Günther, 1864: 428; Dubois, 1974b: 385.
Rhacophorus maculatus – Boulenger, 1882: 83; Boulenger, 1890: 475; Leviton, Myers & Swan, 1956: 9; Swan & Leviton, 1962: 109; Malla, 1981: 141.
Rhacophorus macluatus (sic!) - Waltner, 1975a: 25.

Literature references. — Thondarkot, 1640-1680 m: 157 tadpoles, MAC T033-189, 12-VIII-1972, 16 juv., MAC 001-016, 12-VIII-1972, leg. A. Dubois (Dubois, 1974b). Hyengja, 1200-1220 m: 32 tadpoles, MAC T001-032, 9-VIII-1972, leg. A. Dubois (Dubois, 1974b).

Diagnosis. — A rhacophorid frog; snout-vent length about 57 mm in males and 89 mm in females. Head broad, generally bony and rugose in adult specimens; snout subtriangular; canthus rostralis distinct; loreal region concave; tympanum nearly as large as the eye. Fingers with rudimentary webbing, toes entirely webbed. Disks of fingers and toes well developed, those of fingers considerably larger; subarticular tubercles moderate; a single small inner metatarsal tubercle present. The tibio-tarsal articulation reaches the tip of the snout. Skin of dorsal parts smooth, strongly granular on belly and ventral surface of thighs. Colour variable; dorsally usually greyish or brown, with or without brown to black spots and a large hourglass-shaped figure on the

posterior part of the head and the anterior part of the back; limbs with small, more or less distinct, brownish cross-bars. Male with an internal vocal sac.

Habitat. — No data available.

Distribution. — See fig. 13. An Indian species. Range: India, Sri Lanka, central and eastern Nepal.

ZOOGEOGRAPHICAL AND ALTITUDINAL ANALYSIS AND DISCUSSION

In the Annapurna-Dhaulagiri region Tibetan, Western Himalayan, Eastern Himalayan, Indo-Chinese, Indian and Panoriental species meet in a very restricted area. In this respect this area is unique. The species recorded for this area can be divided according to table 1. The criteria for this division are:

- Tibetan species: Only distributed in the dry, high altitude area north of the Himalayas (Tibetan Plateau).
- Himalayan species: Species distributed in the Western as well as the Eastern Himalayas, but not found in the surrounding lowlands, and species with a very limited distribution in central Nepal.
- Western Himalayan species: These are distributed in the Western, but not in the Eastern Himalayas. For most species the distribution limit is the Dhaulagiri Himal (Jaljala Pass) or the dry Himalayan valley of the Marsyandi.
- Eastern Himalayan species: These are distributed in the Eastern, but not in the Western Himalayas. As yet, none of these species is found west of the Dhaulagiri Himal (Jaljala Pass).
- Indo-Chinese species: Species which range far into the Indo-Chinese subregion (as defined by Wallace, 1876), but which are not found in India, with the exception of the eastern part (Orissa is the most western locality).
- Panoriental and Indian species: These are distributed throughout large parts of India. Some of these species have a Middle Eastern and/or Indo-Chinese distribution as well.

The Tibetan species live in a desert-like habitat that is quite different from all other habitats in the Annapurna-Dhaulagiri region. The transition of this habitat to the wetter forest habitats occurs over a short distance in the Kali Gandaki Gorge and over a somewhat larger distance in the Manang Valley. Dispersal of Tibetan species to Manang Valley, however, is obstructed by a high mountain range, the Muktinath Himal (see p. 89). Consequently in central Nepal the Tibetan species are restricted to a small area north of the main Himalayan chain in the Thak Khola Valley (upper reaches of Kali Gandaki).

	Mean altitude ± SD	Range	Habitat
Tibetan species			
Phrynocephalus theobaldi	3363 ± 445	2890-4000	T
*Scincella l. ladacensis**	5185 ± 431	4880-5490	T, A
Scutiger alticola	3710 ± 217	3570-3960	A
Rana parkeri	2795	–	T
	3789 ± 792	2795-5490	
Himalayan species			
Scincella capitanea	1775 ± 256	1400-2100	Foak
Amphiesma platyceps	2122 ± 562	1040-3100	Friv, Foak, Fcon
Elaphe hodgsonii	2970 ± 325	2740-3200*	Fcon, Fc ?
Trachischium fuscum	1900	–	Foak, Fc ?
Bufo himalayanus	2125 ± 357	1300-2650	C, R, Fc
Rana liebigii	2195 ± 432	1560-2930	Foak, Frho, Fcon
Rana polunini	3297 ± 564	2640-3990	Frho, Fcon, A
Rana rostandi	2826 ± 309	2400-3500*	Fcon
Rana cf. *rara**	3020	–	Fcon
Amolops formosus	2157 ± 403	1800-2650	Foak, Fcon
	2439 ± 535	1040-3990	
Western Himalayan species			
Agama tuberculata	2001 ± 696	790-3400	C, R
*Scincella l. himalayana**	3212 ± 191	2950-3440	Fcon, A
*Japalura major**	3650	–	Frho, Fcon ?
Agkistrodon himalayanus	2486 ± 387	1640-3050*	Fcon, A
*Scutiger nepalensis**	3030 ± 96	2920-3100	Fcon, A
	2876 ± 643	790-3650	
Eastern Himalayan species			
Japalura tricarinata	2310 ± 274	1830-2850	Foak, Frho, Fc
Scincella sikimmensis	2447 ± 417	1340-3200	Fc
Rhabdophis himalayanus	1690 ± 520	1100-2350	C, Fc ?
Scutiger sikimmensis	2860 ± 53	2800-2930	Foak, Frho
Megophrys parva	1842 ± 309	1230-2440	C, Foak, Fc
Rana sikimensis	1512 ± 198	1210-1770	Friv, Foak
Amolops afghanus	1461 ± 254	1040-1840	Friv, Foak
	2017 ± 530	1040-3200	
Indo-Chinese species			
Hemidactylus garnotii	950 ± 14	940- 960	C
Sphenomorphus maculatus	1016 ± 181	820-1300	R, Friv
Trimeresurus albolabris	1483 ± 788	990-3050	C, Friv
Ovophis monticola	1725 ± 247	1550-1900	C, Foak, Fc ?
Sibynophis collaris	2084 ± 292	1815-2500	C, Fc ?
Elaphe radiata	850 ± 353	600-1100	Friv ?
Pseudoxenodon macrops	2180 ± 255	2000-2360	Foak, Fc ?
	1463 ± 616	600-3050	

	Mean altitude ± SD	Range	Habitat
Panoriental and Indian species			
Hemidactylus brookii	960	–	C
Hemidactylus flaviviridis	960	–	C
Calotes versicolor	1260 ± 269	880-1660	C
Ophiophagus hannah	1530	–	Friv
Amphiesma stolata	1262 ± 237	900-1640	C
Xenochrophis piscator	1147 ± 242	960-1500	C
Elaphe helena	1207 ± 414	914-1500	C ?
Lycodon aulicus	1522 ± 860	914-2130	C
Ptyas mucosus	1087 ± 339	800-1750	C, Friv
Boiga trigonata	1100	–	C, Friv
Rhamphotyphlops braminus	900	–	C
Bufo stomaticus	987 ± 190	800-1400	C
Bufo melanostictus	1381 ± 320	800-2250	C, R
Microhyla ornata	1366 ± 236	930-1620	C
Rana cyanophlyctis	1081 ± 203	760-1660	C
Rana tigerina	1069 ± 257	760-1600	C
Rana limnocharis	1290 ± 304	820-2030	C, R
Rana breviceps	930	–	C
Polypedatus maculatus	1435 ± 318	1210-1660	C, Friv, Foak ?
	1254 ± 308	760-2250	

Table 1. — Division of the reptiles and amphibians of the Annapurna-Dhaulagiri region in zoogeographical groups. For each species and group the mean altitude and the altitudinal range of known localities (as listed under "material examined", "literature references" and "field observations") is listed, as well as the habitat. * Species not recorded east of Jaljala Pass (Dhaulagiri region) or highest locality is west of Jaljala Pass. Habitat: C - cultivated land; R - river valleys; Friv - riverine forest; Foak - oak forest; Frho - rhododendron forest; Fcon - coniferous forest; Fc - forest clearings; T - Tibetan high altitude steppe; A - alpine meadows. ? - habitat not exactly known.

The Panoriental and Indian species, coming from the southern plain, were usually restricted to open (cultivated) land. In the Himalayas their dispersal stopped at the lower forest edge. Table 2 shows that the distribution of the Panoriental and Indian species is not at random, but that most species are found in cultivated land and only few (occasionally) in forests.

Going east from Kashmir the number of species with western affinities decreases gradually until Jaljala Pass is reached. Only two western species (of five known to occur in the Dhaulagiri region) are found east of Jaljala Pass. This pass is only 3400 m high and most species can be assumed to be able to pass this spur of the Dhaulagiri Himal along the southern side. The real barriers are probably the differences in climate and vegetation between both sides

of the pass. The area west of the pass, called the Garhwal Himalayas (Troll, 1967), is relatively dry and dominated by coniferous forests. In the Sikkim Himalayas, east of Jaljala Pass, the vegetation mainly consists of oak forests. This area receives much precipitation, especially south of the Annapurna Himal and farther east (Sikkim). The two western species that are found east of Jaljala Pass, *Agama tuberculata* and *Agkistrodon himalayanus,* occupy dry habitats in central Nepal. Their distribution is disjunct and is possibly a relic of a wider distribution in drier, glacial periods.

Dispersal of eastern species (Eastern Himalayan + Indo-Chinese species) to central Nepal is obstructed by one large barrier, the Arun River, which reaches far north into Tibet. According to Swan & Leviton (1962) the Singalehla Himal, at the border between Nepal and Sikkim, already forms a barrier; in 1962 only 15 Indo-Chinese species were known from Nepal against 51 known from Sikkim/Darjeeling. However, since 1962 the area between the Arun River and the Singalehla Himal was more accurately searched for amphibians than before, and Dubois (1976) mentioned 19 additional species (only nine amphibians were known for eastern Nepal), most of which were eastern species. The conclusion must be that eastern Nepal is dominated by Indo-Chinese and Eastern Himalayan species. Many of these were able to cross the Arun River and they make up 42% of the central Nepalese herpetofauna. According to Swan & Leviton (1962) the influence of the Indo-Chinese Subregion diminishes quickly in Nepal, but continues to Simla in the Western Himalayas. We believe that for reptiles and amphibians central Nepal is the most western part of the Indo-Chinese Subregion; the greater part of its

	Forest		Cultivated		
	expected	observed	expected	observed	χ^2
Himalayan species + W. Himalayan species	5,5	9,5	5,5	1,5	5,8
E. Himalayan species + Indo-Chinese species	7,0	10,5	7,0	3,5	3,5
Panoriental species + Indian species	9,5	2,5	9,5	16,5	10,3

Table 2. — Forest dwelling and cultivated-land dwelling habits of different zoogeographical groups. The expected values are calculated on the assumption that the species are equally distributed between forests and cultivated land. The observed values are calculated from the last column of table 1 (a species with only F's is given one point for forest, a species with one or more F's and one C is given half a point for forest and half a point for cultivated-land, etc.). Some groups are combined in order to obtain expected values above 5. At $P = 0.05$, $\chi^2 = 3.84$.

herpetofauna has eastern affinities. West of it only two eastern species (out of 14 recorded for the Annapurna region), i.e. *Trimeresurus albolabris* and *Sibynophis collaris,* are known to occur.

As well as the western species, many eastern species have a disjunct distribution in central Nepal at present. The Eastern Himalayan species *Japalura tricarinata, Scutiger sikimmensis, Rana sikimensis* and *Scincella sikimmensis* are restricted to the very humid oak and rhododendron forest zone. They are known from numerous localities in the Annapurna region and in the area of eastern Nepal, Sikkim/Darjeeling, but from only a few localities in between. A possible explanation could be that the collectors of the several expeditions visiting the area in between (see e.g. Leviton, et al., 1956; Acharji, 1961; Kripalani, 1961) were not very proficient in locating these species. This may be true for some of the species mentioned, but surely *Scincella sikimmensis* is not difficult to find and to collect. A better explanation probably is, that their disjunct distribution is caused by their humid habitat requirements. The distribution of *Quercus lamellosa* forests (Dobremez & Jest, 1971; Dobremez et al., 1974) indicates that such humid habitats are scarce in central Nepal, east of the Manaslu Himal (mountain range just east of the Annapurna Himal; the Manaslu Himal has, as far as we know, never been visited by collectors or reptiles and amphibians) and indeed occur at the few localities known for these species: the area south of Langtang (north of Kathmandu Valley), the hills around the Kathmandu Valley and the Rolwaling Himal. Dubois (1976) suggested that the disjunct distribution of *Rana sikimensis* is a relic of a period when precipitation was higher all over Nepal and this may be true for all four species mentioned.

Also some Indo-Chinese species appear to have a disjunct distribution. These are mainly species living in the riverine and oak forests at lower altitudes, which are seriously effected by deforestation. Their distribution is not decreased by climate but by man.

In the introduction a hypothesis was presented which predicts that reptiles and amphibians will occur at higher altitudes in the drier parts of a mountain area, because clouds less often veil the sun there and consequently the number of sun hours is higher. Our research was mainly intended to confirm this hypothesis by comparing the northern, dry side and the southern, wet side of the Annapurna Himal. Unfortunately the contrasts in climate and vegetation between these two sides are so extreme that most species, because of their habitat requirements, are restricted to one side of this mountain range. The two species that occur on both the northern and the southern side indeed confirm the hypothesis. *Rana polunini* was collected at 3990 m in the dry alpine

meadows above Marpha and at 3580-3960 m near Muktinath. On the southern side of the Annapurna it is, as yet, not found above 2930 m (Ghorapani). The highest recorded locality for the second species, *Agama tuberculata,* is above Jomosom at 3310 and 3400 m on the northern side of the Annapurna and at 2250 m (Ghandrung forest) on the southern side.

Not only is there a difference in the amount of precipitation and consequently in the amount of sun hours between the northern and the southern side of the Himalayas, but also between the Sikkim and the Garhwal part of the Himalayas. The Garhwal Himalayas are drier because the influence of the monsoon diminishes to the west. Table 3 shows that species distributed in both the Sikkim Himalayas and the Garhwal Himalayas, occur at a higher altitude in the latter area (the only exception is *Rana polunini,* but its locality at 3990 m in the Sikkim Himalayas is north of the main Himalayan chain (see above). It also holds true for the total herpetofauna; the localities of the Western Himalayan species have an average altitude of 2876 ± 643 m and for the Eastern Himalayan species this figure is 2017 ± 530 m (see tab. 1).

The average altitude of localities of the Indo-Chinese species is even lower, 1463 ± 616 m. This is logical. These species occur in the Eastern Himalayas, but range in the Indo-Chinese lowlands as well. Consequently they are adapted to lower altitudes, or to put it another way, to higher temperatures and/or more open, cultivated terrain. Hence the proportion of species of this group living in cultivated terrain in the Annapurna region is higher than that of Himalayan species living in cultivated terrain. The lower altitudinal range of the Indo-Chinese forest-dwelling species, forces them to live in the riverine forests of lower altitudes, a habitat that is quickly disappearing. This is mainly due to deforestation for fire-wood. It probably explains the rarity of some of these species (and also of *Ophiophagus hannah,* a Panoriental species).

All Panoriental and Indian species listed in table 1 also live in the Ganges Plain and Terai of southern Nepal. These areas are largely cultivated and most species that survived here are more or less perianthropic species. The same holds true for the species that were able to extend their range into the southern hills and into some of the Himalayan valleys. The most abundant amphibians, *Rana cyanophlyctis, Rana tigerina, Rana limnocharis, Bufo stomaticus* and *Bufo melanostictus* occur almost exclusively in or near the rice-fields and man-made chanels and ponds. The most common Nepalese snake, *Amphiesma stolata,* feeds on them. The average altitude of localities known for this group is the lowest of all groups: 1254 ± 308 m. Most species are probably restricted to these open, man-made habitats and their range ends abruptly at the edge of the forest.

Species	West of Jaljala Pass		East of Jaljala Pass	
	west of study area	study area	study area	east of study area
Agama tuberculata	3660 m	not rec.	3400 m	2130 m
Agkistrodon himalayanus	4880 m	3050 m	2700 m	not rec.
Amphiesma platyceps	3660 m	not rec.	3100 m	2800 m
Elaphe hodgsonii	5000 m	3200 m	2740 m	1700 m
Rana polunini	3510 m	not rec.	3990 m	3380 m
Rana rostandi	not rec.	3500 m	2910 m	not rec.

Table 3. — Highest altitude recorded for high altitude species (recorded above 3000 m) that occur both west and east of Jaljala Pass. Altitude records for the area outside the study area taken from: Dubois, 1974b (*Rana polunini*), Kramer, 1977 (*Amphiesma platyceps*, east; *Elaphe hodgsonii*), Smith, 1943 (*Agkistrodon himalayanus*), Smith, 1951 (*Agama tuberculata*, east; *Rana polunini*), Smith & Battersby, 1953 (*Amphiesma platyceps*, west), Stoliczka, 1872a (*Agama tuberculata*, west).

Most Himalayan species (including Western and Eastern Himalayan species) are forest or forest-edge species (tab. 2). They probably are restricted to this habitat by the actual habitat structure and/or the microclimate; in areas where the forest has been destroyed (e.g. around Tang Ting), most species have disappeared.

Dierl & Gruber (1979) suggested that, with the exception of *Japalura tricarinata*, there are no forest dwelling reptiles or amphibians in the Annapurna region: "At first sight it seems that many species of amphibians and reptiles (skinks, snakes, frogs, toads) enter the forest, but they always keep to more or less open places caused by human influence, such as footpaths, forest-pastures or localities strongly degraded by cattle grazing". This conclusion appears to be premature. These forests are difficult places in which to look for reptiles and amphibians and very few people probably have done so. Consequently most forest-dwelling species have usually been collected on the paths and clearings. Now some species have actually been collected or seen in forests with a closed canopy, e.g. *Amphiesma platyceps* (RMNH 20503) and an unidentified snake were respectively collected and seen deep inside the Tang Ting forest. Several specimens of *Scincella capitanea* were collected in the forest as well. Of the frogs that live close to small mountain streams many specimens were collected away from the footpaths or clearings in a forest with a closed canopy, i.e. *Rana liebigii, Rana polunini, Amolops formosus* and *Scutiger sikimmensis*. So the real (and facultative) forest species were still unknown from this habitat in 1979, because they were not sufficiently searched for or escaped the collectors' attention, not because they did not occur there.

No species are known from the alpine meadows of the southern slopes of the Annapurna range. *Scincella sikimmensis*, usually a species of forest clearings, was found on small patches of the alpine meadow habitat around Ghorapani, the highest locality (Poon Hill, 3200 m, RMNH 20443) reported sofar. However, this species was never found in more extensive areas of alpine meadows. In the Lamjung Himal (above Tang Ting) an extensive area of alpine meadows was visited in September 1978 by Ouboter and Van Meeuwen and in April 1981 by Nanhoe and Ouboter, but not a single species was found. *Scincella sikimmensis* could not be found above 2530 m, although a series of clearings continued above this altitude, and it was also absent from the alpine meadows. Dierl & Gruber (1979) suggested that the dense forests that cover the lower slopes of the Annapurna Himal form a barrier for all the species that live below the forest or in clearings. As mentioned above, they do not recognize forest dwelling species, except *Japalura tricarinata*. Their explanation is not completely satisfactory, because it does not exclude the possibility that: 1. facultative forest species, like *Amphiesma platyceps* and *Rana polunini*, could extend their range to higher altitudes. 2. species living on the dry alpine meadows on the northern side of the Himalayas, like *Scutiger alticola* and *Rana polunini,* could disperse to the southern side above the timberline of the monsoon forests. The absence of reptiles and amphibians from the alpine meadows of the southern slopes of the Annapurna Himal has to be explained in another way. A possible explanation is presented by the hypothesis discussed above (p. 85): During the warmest months of the year, the monsoon clouds veil the sun on the southern slopes of the Annapurna and therefore make the area unsuited for thermophilic (needing warmth) reptiles and amphibians, which are otherwise able to live at very high altitudes. *Rana polunini* is found at almost 4000 m on the dry alpine meadows on the northern side of the Annapurna Himal, and in the Garhwal Himalayas, which have a drier climate, *Amphiesma platyceps* and *Agkistrodon himalayanus* are known to occur on alpine meadows at an altitude of 3660 m and 4880 m, respectively (table 3).

The absence of all reptiles and nearly all amphibians from Manang Valley (upper reaches of the Marsyandi River) is very remarkable. *Rana polunini* is the only amphibian found here, just at the beginning of the valley at Pisang. This area resembles the Kali Gandaki Valley between Kalopani and Marpha with open coniferous forests, an area where two lizards, two snakes and four amphibians are known to occur. Of these eighth species, four are recorded from the Marsyandi Valley (downstream of Manang Valley), i.e. *Agama tuberculata, Scincella sikimmensis, Agkistrodon himalayanus* and *Bufo himalayanus,* and three species are likely to occur there as well, i.e. *Am-*

phiesma platyceps, Rana polunini and *Rana liebigii.* Only the eighth species, *Rana rostandi,* is not known to occur so far to the east. It is possible that both snakes occur in the area around Pisang, but that they are rare and difficult to find. The absence of the lizards and of *Bufo himalayanus,* which are easy to find when present, should be explained in another way. Just south of Pisang the forest is very dense and this could be a barrier for the heliotherm *Agama tuberculata* and perhaps also for *Scincella sikimmensis.* The last mentioned species is recorded from a clearing south of Bradang, but is absent from the forest between Bradang and Pisang, a forest that has few, if any, clearings. We have no explanation for the absence of *Bufo himalayanus* northwest of Bagarchap.

The western part of Manang Valley is very dry and resembles the Kali Gandaki Valley (Thak Khola Valley) between Marpha and Muktinath, an area where the following species have been recorded: *Agama tuberculata, Phrynocephalus theobaldi, Scutiger alticola* and *Rana polunini. Agama tuberculata* is absent from the eastern part of Manang Valley and probably is not able to enter the valley from the west, where the lowest point in the mountain range (Muktinath Himal) is Meso Kanto Pass at 5100 m. The two Tibetan species, *Phrynocephalus theobaldi* and *Scutiger alticola* probably are not able to cross the Muktinath Himal too; the highest locality known for any of the two species is 4000 m. *Rana polunini* probably occurs in the western part of the Manang Valley, but we were unable to find it in a search of several days in the vicinity of Ongre (20 km southeast of Manang).

Some more interesting conclusions can be drawn when the known herpetofauna of the Annapurna area, which is at the western boundary of central Nepal and the Sikkim Himalayas is compared with the herpetofauna of central Nepal as mentioned by Swan & Leviton (1962: tab. 1) (tab. 4). Note that the way to assign the species to certain zoogeographical groups (left hand and middle column) is not very different, with the exception of the Himalayan and Western Himalayan species. This is mainly due to recent knowledge on range extensions of species formerly only known from the Eastern or the Western Himalayas. Differences with the groups of Swan & Leviton (1962) are already explained in the parts dealing with the distribution of each species separately.

The differences between the middle and the right hand column of table 4 are the resultant of the 17 species new for Central Nepal since 1962 (two species are not included in the middle and right hand column, because they were described as new species after 1962) and the 10 species known to occur in central Nepal before 1962, but not (yet) recorded for the Annapurna region. These species are listed in table 5. Central Nepal is defined as the area

between the Dhaulagiri Himal (Jaljala Pass: 83°15'E) in the west and the ridge separating the Arun Valley from the Dudh Kosi (87°E) in the east; the Terai, south of the Siwalik Range, is excluded. From table 5 it can be seen that the species added to our knowledge on the herpetofauna of central Nepal since 1962, come from every zoogeographical group. All three Tibetan species were only recently discovered in this area. Of the six species recorded for central Nepal for the first time (second column) five are lizards (which is the smallest group with only 10 species, 21% of all species) and one is a snake. Apparently the amphibians of this area are well known by now, mainly because of the work of Dubois (1974b, 1975, 1976). The snake fauna was studied by Kramer (1977), but no one paid special attention to the lizards. Consequently, up till now five of the ten species (50%) were not known to occur in central Nepal.

It is very remarkable that of the species known to occur in central Nepal, but not yet found in the Annapurna region (third and fourth column), 13 of the 17 (76%) are eastern species (i.e. Eastern Himalayan + Indo-Chinese species) and 13 (76%) are snakes. Since it is highly improbable that some barrier that could be crossed by lizards and amphibians, but not by snakes, exists between the Annapurna region and the Kathmandu Valley (where most species were found), the most likely explanation is that many of these species are not yet found in the Annapurna region, but will probably be found there

	Nanh. & Oub.		Swan & Lev.		C. Nepal	
	abs.	%	abs.	%	abs.	%
Tibetan species	3	6.4	3	6.7	0	0
Himalayan species	9	19.1	4	8.9	7	16.7
Western Himalayan species	2	4.3	4	8.9	3	9.5
Eastern Himalayan + Indo-Chinese species	14	29.8	14	31.1	15	38.1
Panoriental + Indian species	19	40.4	20	44.4	13	35.7
	47		45		38	

Table 4. — Herpetofaunal composition of the Annapurna region (excluding the Dhaulagiri region west of Jaljala Pass) according to table 1 (first column) and divided according to Swan & Leviton (1962) (second column), compared to the herpetofaunal composition of Central Nepal according to Swan & Leviton (1962) (third column). Differences between the first and second column are already explained in the parts dealing with the distribution of each species separately. Terai species and species without exact locality data that were not recorded again after 1900 are excluded from the third column.

in the near future. Eight of these snakes are apparently very rare or difficult to find, since they are known from one record for central Nepal only (marked with * in table 5) or the last record is very old and the locality not exactly known (marked by unk in table 5). The rarity of some of them is probably due to heavy deforestation in the hills.

The range of most reptiles and amphibians is affected by deforestation and its results i.e. land-slides. The effect on the eastern species that live at low altitudes has already been described. Most Panoriental and Indian species (except *Ophiophagus hannah*) are able to extend their range as the area of cultivated land becomes larger. Limited deforestation, with some large or medium-sized areas of forest being spared or the forest only being thinned out, apparently makes it possible for most species to survive in the area. *Agama tuberculata* and *Scincella sikimmensis* even may extend their range, the first one to the rocky areas that are formed by new land-slides and the second one to the forests that are thinned out by cattle grazing. For *Japalura tricarinata, Scincella capitanea* and some of the snakes and frogs, however, even small impact on the forest is likely to be disasterous, because of the destruction of their habitat and/or because they will be more exposed to man, who eats some of the frog species and usually kills the snakes if given the opportunity.

SUMMARY

During a trek around the Annapurna Himal and along the southern side of the Dhaulagiri Himal, 11 species of lizards, seven species of snakes and 18 species of amphibians were collected. *Phrynocephalus theobaldi* and *Sphenomorphus maculatus,* have not been reported from Nepal before, although they are present in the collections previously made by Gruber, and Hyatt, respectively. *Scincella capitanea* is a species recently described by Ouboter (1986). *Ophiophagus hannah* was seen, but not collected, the first record for the Nepalese hills. From other unreported collections and literature records an additional two species of lizards, ten species of snakes and three species of amphibians are known to occur in the Annapurna-Dhaulagiri area. A short diagnosis and notes on habitat and distribution are given for all species. For an altitudinal and zoogeographical analysis they are divided into six groups: Tibetan species, Himalayan species, Western Himalayan species, Eastern Himalayan species, Indo-Chinese species and Panoriental and Indian species. This analysis resulted in the following conclusions:

- In central Nepal, Tibetan species are restricted to a small, dry area north of the main Himalayan chain in the Thak Khola Valley.
- Panoriental and Indian species are usually restricted to open, cultivated land at rather low altitudes. Consequently they do not range far into the Himalayas.

	Not rec. for C. Nepal by S. & L.	Not rec. for C. Nepal by any author	Rec. for C. Nepal by S. & L; not rec. for Anna-purna reg.	Rec. for C. Nepal since 1962; not rec. for Anna-purna reg.
Tibetan species	3	1	0	0
Phrynocephalus theobaldi	+	+		
Scutiger alticola	+[1]			
*Rana parkeri**	+[1]			
Himalayan species	3	1	3	0
Scincella capitanea	+	+		
Rana rostandi	+[2]			
Amolops formosus	+[1]			
Liopeltis rappii[unk]			+	
Oligodon erythrogaster			+	
*Boiga multifasciata**			+	
Western Himalayan species	1	0	0	0
Agkistrodon himalayanus	+[3]			
Eastern Himalayan and Indo-Chinese species	5	3	6	7
Hemidactylus garnotii	+	+		
Sphenomorphus maculatum	+	+		
*Ophiophagus hannah**	+	+		
Pseudoxenodon macrops	+[3]			
Amolops afghanus	+[2]			
Cosymbotus platyurus			+	
Calliophis maclellandii			+	
*Naja naja kaouthia**				+[4]
*Trimeresurus jerdoni**				+[3]
Trimeresurus stejnegeri			+	
*Trachischium guentheri**			+	
Trachischium tenuiceps			+	
Zaocys nigromarginatus[unk]			+	
*Boiga cyanea**				+[5]
Boiga ochracea				+[3]
Rhacophorus maximus				+[6]
Kaloula pulchra ?				+[6]
Uperodon globulosum ?				+[6]

	Not rec. for C. Nepal by S. & L.	Not rec. for C. Nepal by any author	Rec. for C. Nepal by S. & L; not rec. for Annapurna reg.	Rec. for C. Nepal since 1962; not rec. for Annapurna reg.
Panoriental and Indian species	7	1	1	0
Hemidactylus brookii	+[7]			
*Hemidactylus flaviviridis**	+	+		
Elaphe helena	+[3]			
Rhamphotyphlops braminus	+[5]			
Bufo stomaticus	+[1]			
Microhyla ornata	+[1]			
Rana breviceps	+[1]			
*Oligodon arnensis**			+	

Table 5. — Species new for Central Nepal since Swan & Leviton (1962) (first column) or species now recorded for Central Nepal for the first time (second column) and species not recorded for the Annapurna region, which were recorded for Central Nepal by Swan & Leviton (1962) (third column) or afterwards (fourth column). * - Species known from one record only in the Central Nepalese hills or mountains (Terai excluded). unk - Species of which the exact locality is unknown. References: 1 - Dubois, 1974b; 2 - Dubois, 1974a; 3 - Kramer, 1977; 4 - Acharji, 1961; 5 - Fleming & Fleming, 1974; 6 - Dubois, 1976; 7 - Majupuria, 1981. ? - Exact locality not specified by Dubois, 1974b.

- Jaljala Pass and the southern spur of the Dhaulagiri Himal seem to be distribution barriers between the herpetofauna of western and eastern origins. Only two western species, *Agama tuberculata* and *Agkistrodon himalayanus,* are known to occur east of the pass and only two eastern species, *Trimeresurus albolabris* and *Sibynophis collaris,* west of it. The two western species mentioned have a disjunct distribution in Central Nepal.
- Most Eastern Himalayan forest species are known from numerous localities in the Annapurna area and eastern Nepal + Sikkim/Darjeeling, but only from few localities in between. This is probably due to the relative dryness of the area between the Annapurna/Manaslu ranges and eastern Nepal, where relic populations survived only in the most humid localities.
- Some evidence is provided for the hypothesis that species living in dry regions are able to range to higher altitudes than species living in wetter areas, because of a higher number of sun hours:

  1. The only two species that are found on the northern as well as the southern side of the Annapurna Himal, *Rana polunini* and *Agama tuberculata,* occur both much higher in the dry Thak Khola region on the northern side than in the wet area on the southern side.

2. Species that occur in both western and central Nepal range to higher altitudes in western Nepal, which has a drier climate.
3. The localities of the Western Himalayan species have an average altitude of 2876 m, those of the Eastern Himalayan species of 2017 m.
4. No species are known from the alpine meadows on the southern side of the Annapurna, although some of the forest species that occur on the southern side are known to live on the alpine meadows in the drier regions of western Nepal and/or the northern side of the main Himalayan chain.

- Himalayan species (including Western and Eastern) are mostly forest or forest edge species. Several species have been recorded from dense forests with a closed canopy.
- Apart from *Rana polunini* no reptile or amphibian has been recorded from the Manang Valley. High mountains form a barrier in the west; in the east dense forests probably prevent the passage of all heliotherm species.
- The lizards proved to be the least known group: five of the ten species recorded for the Annapurna area are recorded for the first time from central Nepal.
- Of the species that were recorded from central Nepal by various authors, but have not yet been found in the Annapurna area, most are eastern species and snakes.
- Severe deforestation will cause changes in the range of most species. The Panoriental and Indian species will probably extend their range, as well as *Agama tuberculata*, for which land-slides, a side-effect of deforestation, form a preferred habitat. The range of all Himalayan species probably will decrease.

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